Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
DEEMED TO BE
University
(Estd. u/s 3 of UGC Act, 1956)
Avadi, Chennai

Office of the Dean
Research Studies

Proceedings of

A National Level Research Event

Dr. Sagunthala Rangarajan Annual-Research Scholar Symposium (SRASS) – 2026

20 FEBRUARY 2026

Venue: **Convocation Hall, Vel Tech**

ISBN: 978-81-987992-2-7

Vel Tech
Rangarajan Dr. Sagunthala R&D Institute of Science and Technology
DEEMED TO BE
University
(Estd. u/s 3 of UGC Act, 1956)
Avadi, Chennai

NAAC A++ HIGHEST GRADE

Recognised as CATEGORY-1 DEEMED TO BE UNIVERSITY by the UGC University Grants Commission

Office of the Dean Research Studies

Cordially invite you to

A National Level Research Event

Dr. Sagunthala Rangarajan Annual-Research Scholar Symposium (SRASS) – 2026

20th February 2026 | 9.30 am onwards | Convocation Hall, Vel Tech

Chief Guest

Dr. Krishna Kanth P
Scientist E
Technology, Translation and Innovation (TTI) Division,
Department of Science & Technology, New Delhi

Resourse Persons & Jury

Dr. Suresh K I
Chief Scientist
Material Sciences
CSIR - National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram

Dr. Balasubramanian E
Professor, Mechanical Engg. & Dean – Centre for International Affairs
National Institute of Technical Teachers Training and Research Institution (NITTTR), Chennai

Dr. Masilamani V
Professor, CSE
Indian Institute of Information Technology, Design and Manufacturing(IIITDM), Kancheepuram

Dr. Kumarappan N
Professor, EEE
Chair IEEE Madras section
Annamalai University, Chidambaram

Dr. Rajendra Prasath
Associate Professor, CSE
Indian Institute of Information Technology (IIIT), Chittoor

Dr. Satyasai Jagannath Nanda
Associate Professor, ECE
Malaviya National Institute of Technology (MNIT), Jaipur

Dr. Bhavadharini R M
Associate Professor,CSE
Vellore Institute of Technology (VIT), Chennai

Dr. Arul T
Convenor
CREDAI - Skill Development, Chennai

Dr. Hari Kumar K
Chief Executive Officer
LabGig, Bengaluru

Mr. Vignesh C
Technology Commercialization Officer
DST Technology Enabling Centre (TEC), Anna University, Chennai

Dr. Vinod V. T Padil
School of Nano Sciences
Central University of Gujarat, Vadodara

With the Blessings of

Col. Prof. Dr. Vel R. Rangarajan
Founder President & Chancellor

Late. Dr. Sagunthala Rangarajan
Foundress President

Prof. Dr. Rajat Gupta
Vice Chancellor

Convenors

Prof. Dr. K. Jagajjanani Rao
Dean (Research Studies)

Prof. Dr. M. Vinod Kumar
Associate Dean (Research Studies)

Dr. A. Prasanth
Assistant Dean (Research Studies)

@veltechuniversityofficial @veltechofficial www.veltech.edu.in #PassionateDoers

No.42, Avadi - Vel Tech Road, Vel Nagar, Avadi, Chennai - 600 062.| TOLL FREE 1800 212 7669

Table of Contents

CSEP01

A Hybrid Attention-Guided Deep Autoencoder Framework for Real-Time Epileptic Seizure Forecasting in Edge-Cloud Environments

Madhumitha C[1], Murali Dhar M S[1*]

[1,1*]Department of Computer science and Engineering, Vel Tech Rangarajan Dr Sagunthala R & D Institute of Science and Technology Chennai-600062, Tamil Nadu, India

Abstract

Epileptic seizure forecasting from electroencephalogram (EEG) signals remains a critical yet challenging problem due to the non-stationary, patient-specific, and highly imbalanced nature of neural dynamics. This paper proposes a Hybrid Attention-Guided Deep Autoencoder Framework for real-time epileptic seizure forecasting in distributed edge-cloud environments. The proposed architecture integrates a multi-scale convolutional encoder with a latent space attention mechanism to capture discriminative spatio-temporal representations from raw EEG signals. A gated temporal modelling module is incorporated to enhance preictal pattern learning, while an adaptive reconstruction objective improves robustness against artifacts and noise. To enable real-time deployment, a collaborative edge-cloud computing strategy is designed in which lightweight feature extraction and preliminary inference are performed at the edge device, and computationally intensive model refinement and personalization are executed in the cloud. This design significantly reduces latency while maintaining high predictive accuracy. Furthermore, a class-imbalance-aware loss function is introduced to address the rarity of preictal events, improving sensitivity without increasing false alarm rates. Extensive experiments conducted on benchmark EEG seizure datasets demonstrate that the proposed framework achieves superior performance in terms of sensitivity, specificity, F1-score, and false prediction rate per hour compared to state-of-the-art deep learning models. The system maintains low inference latency suitable for real-time clinical applications. The proposed hybrid attention-guided framework offers a scalable, energy-efficient, and clinically viable solution for proactive seizure management, paving the way toward intelligent edge-enabled neurological monitoring systems.

Keywords: Epileptic seizure forecasting; Electroencephalogram (EEG); Hybrid deep learning; Attention mechanism; Autoencoder; Edge-cloud computing; Real-time prediction; Class imbalance; Spatio-temporal modeling; Intelligent healthcare systems.

CSEP02

A Federated Attention based on Pearl Millet Disease Detection using Multisource Imaging and IoT Data

Vinodhini K[1], Srinivasan R[1*]

[1,1*]Department of Computer science and Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Pearl millet is a vital cereal crop widely cultivated in arid and semi-arid regions, where crop diseases significantly reduce yield and quality. This work proposes a Federated Attention-Based Disease Detection System that integrates multisource imaging data (RGB, thermal, and hyperspectral images) with IoT sensor data (soil moisture, temperature, humidity, and pH levels) for accurate and real-time disease identification. The system leverages federated learning to enable decentralized model training across multiple farms without sharing raw data, thereby preserving data privacy and enhancing scalability. An attention mechanism is incorporated to selectively focus on critical visual and environmental features, improving classification performance. The proposed approach enhances early disease detection, reduces crop losses, and supports precision agriculture practices. Experimental results demonstrate improved accuracy, robustness, and privacy preservation compared to conventional centralized models.

Keywords: Federated Learning, Attention Mechanism, Pearl Millet Disease Detection, Multisource Imaging, IoT Sensors, Precision Agriculture, Deep Learning, Smart Farming, Privacy-Preserving AI, Crop Health Monitoring

CSEP03

Hybrid Evolutionary Optimization and Digital Twin Architecture for Smart Clinical Queue Orchestration

Gajalakshmi S[1] and Vinoth Kumar S[1*]

[1,1*]Department of Computer science and Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology Chennai-600062, Tamil Nadu, India

Abstract

Effective hospital queue management is essential in avoiding overcrowding, minimizing patient waiting times and optimizing the utilisation of scarce medical resources. Conventional queue systems and machine learning driven methods fail to respond to the dynamic and uncertain environment of smart hospitals resulting in workflow bottlenecks and delayed treatment of patients. To overcome these obstacles, Adaptive Digital Twin Driven Queue Management (ADT-QM) framework with a Hybrid Coyote Whale Optimizer (HWO) is proposed. Every patient is linked to a light-weight digital twin that continuously records multimodal inputs like voice biomarkers, symptom trajectories, triage categorization and resource allocations. These digital twins are refreshed in real time with IoT-enablement sensors and cloud histories that create a simulation layer of hospital operations. The optimization engine allocates medical resources dynamically, optimizes transfer routes to avoid bottlenecks and overcrowding and prioritizes patient queues. Experimental assessments on multi-source hospital datasets prove that the ADT-QM framework proposed has an accuracy of 97.6%, decreases patient waiting times by 42.5% and optimizes resource utilization to more than 91%than conventional and digital twinâ€“only systems.

Keywords: Digital Twin, Queue Management, Bio-Inspired Optimization, Smart Hospitals, Patient Flow Prediction

CSEP04

Adaptive Nutrient Management in Chilli Cultivation Using Reinforcement Learning- Driven Smart Fertigation System

Bindhu S[1] and Kujani T[1*]

[1,1*]Department of Computer science and Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Reinforcement learning-based smart fertigation enables adaptive nutrient management in chilli cultivation through real-time, data-driven optimization. Conventional fertigation methods follow fixed schedules that often result in overuse of water and fertilizers, leading to nutrient imbalance and reduced yield. This study presents an IoT-enabled smart fertigation system integrated with soil moisture, pH, and electrical conductivity (EC) sensors to continuously monitor field conditions. A reinforcement learning (RL) agent analyses sensor data and dynamically determines optimal irrigation timing and nutrient concentration based on crop growth stages and environmental variations. The proposed system minimizes resource wastage while maximizing nutrient use efficiency and plant growth performance. Experimental results indicate improved yield, balanced nutrient delivery, and reduced operational costs compared to traditional methods. This approach supports sustainable precision horticulture by providing an autonomous and scalable solution for intelligent chilli cultivation.

Keywords: Reinforcement Learning, Smart Fertigation, IoT, Chilli Cultivation, Precision Agriculture, Adaptive Nutrient Management, Sustainable Farming.

CSEP05

Quantitative 3D MRI Analysis for Parkinson's Disease Diagnosis

Thanam A[1] and Prasanth Aruchamy[1*]

[1.1*]Department of Computer science and Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology Chennai-600062, Tamil Nadu, India

Abstract

Parkinson's disease (PD) is a progressive neurodegenerative disorder primarily caused by the loss of dopaminergic neurons in the substantia nigra, leading to motor dysfunction. Clinical diagnosis is largely symptom-based and often occurs after substantial neuronal degeneration, limiting the effectiveness of early intervention. Conventional neuroimaging techniques show limited sensitivity to early-stage pathological changes. Recent advances in high-resolution volumetric magnetic resonance imaging (MRI) enable the quantitative assessment of subtle structural and microstructural brain alterations. This study proposes an automated 3D MRIâ€"based diagnostic framework to improve the accuracy and objectivity of PD diagnosis. High-resolution T1-weighted MRI data undergo standardized preprocessing, including skull stripping, intensity normalization, N4 bias correction, and spatial registration to the MNI152 template. Quantitative region-of-interest features and deep volumetric features learned via a 3D convolutional neural network are fused and classified using supervised learning. The proposed approach achieves 93.4% accuracy, 92.1% sensitivity, 94.6% specificity, and an AUC of 0.96, outperforming conventional methods and demonstrating strong diagnostic potential.

Keywords: Parkinson's Disease, 3D Volumetric MRI , Quantitative Neuroimaging , 3D Convolutional Neural Network , Automated Disease Diagnosis

CSEP06

Scheduling-Driven Attention CNN-BiLSTM Framework for Prediction Water Quality Parameters

Rohini P[1] and Kanagachidambaresan G R[1*]

[1,1*]Department of Computer science and Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology Chennai-600062, Tamil Nadu, India

Abstract

Accurate prediction of water quality parameters is essential for intelligent and sustainable shrimp aquaculture, where rapid variations in environmental conditions can significantly impact productivity and survival rates. This paper proposes an IoT-enabled deep learning framework for predicting critical water quality parameters, namely pH, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP), using multi-sensor time-series data. A hybrid Attention-based Convolutional Neural Network with Bidirectional Long Short-Term Memory (Attention CNN-BiLSTM) model is employed to effectively capture spatial feature correlations and bidirectional temporal dependencies. To enhance training stability and convergence efficiency two learning rate scheduling strategies ReduceLROnPlateau and CosineAnnealingLR are integrated and comparatively analyzed. Experimental results demonstrate that the scheduler-enhanced Attention CNN-BiLSTM consistently outperforms conventional machine learning and deep learning models. For pH prediction, the proposed model achieves an RMSE of 0.0957 with an RÂ² of 0.9813, while DO prediction attains an RÂ² exceeding 0.998. For ORP prediction, the integration of ReduceLROnPlateau reduces the MAE from 4.7582 to 1.8201, indicating strong robustness for nonlinear parameter estimation. Additionally, CosineAnnealingLR reduces training time by approximately 40% while maintaining competitive prediction accuracy. The results confirm that adaptive learning rate scheduling significantly improves prediction accuracy, stability, and computational efficiency, making the proposed framework suitable for real-time IoT-based aquaculture monitoring systems. In addition, the framework is extended to classify disease risk levels based on predicted water quality conditions, supporting early warning and proactive management.

Keywords: Smart aquaculture; Internet of Things (IoT); Water quality prediction; Attention CNN-BiLSTM; Learning rate scheduling

CSEP07

Development of Internet of Things (IoT) based Precision Cattle position recognition and managerial system

Selvakumari G[1], Kanagachidambaresan G R[1*]
Department of Computer science and Engineering
[1,1*]Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai, 600062, Tamil Nadu, India.

Abstract

India's cattle industry has shown steady growth, with approximately 192.5 million cattle reported in the 20th Livestock Census (2019), and the population is expected to rise further. Despite this growth, the sector faces major challenges, including limited access to affordable livestock monitoring technologies and a shortage of veterinary professionals. Recent outbreaks of diseases such as Foot and Mouth Disease (FMD), Lumpy Skin Disease (LSD), and lameness have severely affected cattle health, with nearly 24.5 million cattle impacted across 15 states and over 97,000 deaths documented. Traditional health monitoring methods rely heavily on manual observation, making early detection of illness, estrus cycles, and nutritional deficiencies difficult. This paper presents the design and deployment of a compact wearable neckband device for real-time precision monitoring of cattle activities. The system integrates IoT, TinyML, and multiple sensors, including an accelerometer, gyroscope, magnetometer, and temperature sensor. By continuously tracking behaviors such as standing, walking, and sitting, the device enables early detection of abnormal patterns. A Random Forest-based machine learning model achieved 93.4% accuracy, outperforming K-Nearest Neighbours, Support Vector Machine, and Hidden Markov Model approaches. The prototype demonstrated 15 days of battery life, ensuring energy-efficient and practical field deployment for improved cattle health and productivity.

Keywords: Internet of Things (IoT), TinyML, Precision Livestock Farming, Machine Learning, Real-time activities monitoring

CSEP08

An IoT-Enabled Colorimetric Sensor Platform for Environmental Monitoring

Mohanapriya D[1] and Kanagachidambaresan G R[1*]

[1,1*]Department of Computer science and Engineering, Vel Tech Rangarajan Dr Saguthula R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

In aquaculture and environmental management, maintaining an optimal pH balance in water is crucial, as fluctuations can profoundly affect aquatic ecosystems, impacting fish physiology, growth, reproduction, and even leading to mass mortality. Water pH balance is vital to aquatic ecosystems, as fluctuations can severely impact fish physiology, growth, and reproduction, sometimes leading to mass mortality. This paper introduces an innovative water quality monitoring system that provides precise, real-time pH measurements, supporting sustainable aquaculture and environmental management. By employing a color-based detection method, the system detects pH changes through an indicator solution, which shifts color according to the sample's acidity or alkalinity. These color changes are instantly analyzed, allowing the system to deliver accurate pH readings based on pre-calibrated data. Designed for ease of use, it automates sample flow, color analysis, and data transmission, minimizing human intervention while maximizing reliability. A mobile interface enables users to monitor water quality remotely, allowing for prompt responses to any imbalances and preventing potential ecological disruptions. This non-invasive approach not only reduces contamination risks but also advances sustainable practices, making the system ideal for applications in aquaculture, environmental monitoring, and water treatment.

Keywords: Aquaculture, color-based detection, intelligent water management, mobile interface, pH monitoring.

CSEP09

Lightweight Hybrid Stacking Ensemble Model for Efficient Multiclass IoT Intrusion Detection Using CICIoT2023 Dataset

Mustapha Ismail Kwari[1] and Rajkumar N[1*]

[1,1*]Department of Computer science and Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

The threat of cyberattacks is on the rise owing to the prominence of the Internet of Things (IoT) globally. Intrusion detection is of utmost significance, and precise and computationally efficient solutions are required for the detection of cyber attacks. However, the limitations of advanced machine learning models are identified. This paper proposes an optimised lightweight stacking ensemble for multiclass IoT cyberattacks on the CICIoT2023 dataset, which comprises 712,311 data samples of IoT network flows belonging to 37 different categories of attack and benign flows. The performance of the model is compared with the performance of the most commonly used classifiers, which have an accuracy of 80%, 78%, and 76% for RF, XGB, and LR, respectively. The performance of the proposed model outperforms all the baselines, achieving an accuracy of 83%. The performance of the proposed model outperforms all the baselines, achieving an accuracy of 83%. The experimental results indicate that the proposed stacking ensemble performs better compared to other baselines in terms of accuracy and weighted metrics; an accuracy of 83% has been reported. In light of these findings, it is shown that lightweight stacking-based ensemble learning can offer a workable solution for large-scale multiclass-based IoT intrusion detection systems in edge computing and IoT platforms with the constraints.

Keywords: Internet of Things security, intrusion detection systems, ensemble learning, stacking classifier, CICIoT2023 dataset.

CSET01

System for Material Volume Analysis and Detection with Computer Vision Techniques

Bhuvanavathi B[1] and Kanagachidambaresan G R[1*]

[1,1*]Department of Computer science and Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

This research presents a computer visionâ€“based system for automated 3D reconstruction and volume analysis of construction materials in stockyards and small-scale industries. Leveraging handheld devices and machine learning techniques, the system generates accurate 3D point cloud data of materials such as sand and stones. Using COLMAP for reconstruction, it enables portable and user-friendly volume estimation with percentage-based analysis and visualization through a mobile application. The framework incorporates point cloud registration techniques to align and superimpose multiple datasets, ensuring reliable monitoring of material usage and requirements. Weekly reporting features allow stockyard operators to track material consumption trends and plan future supply needs efficiently. Designed to be flexible, accessible, and scalable, the system provides civil engineers, industry managers, and researchers with a practical solution for material monitoring, offering enhanced transparency, reproducibility, and industrial applicability across small- to large-scale construction environments.

Keywords: computer vision, volume estimation, 3D reconstruction

CSP01

An Optimized Hybrid CNN-LSTM-GRU Architecture for Intelligent Stroke Detection in IoT Clinical Infrastructure

Prisilla N[1] and Gomathi N[1*]

[1,1*]Department of Computer science, Vel Tech Rangarajan Dr Saguthula R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Since stroke, the leading causes of death and irreversible physically challenge in the globe, timely and accurate detection is the key to successful clinical intervention. Real-time monitoring and diagnosis of strokes are made possible due to the integration of internet of things (IoT) and artificial intelligence (AI) in the healthcare industry. The optimized hybrid deep learning framework presented in this study combines Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU) and Models to detect the stroke signals reliably by EEG signals. To increase the accuracy of categorization and computational effectiveness, the proposed model uses CNN algorithm for spatial feature extraction, LSTT algorithm for temporal sequence learning, and GRU algorithm for learning an effective memory optimization mechanism. In order to ensure a fair and unbiased training of the models, complex data balancing techniques are implemented to deal with data imbalance issues which are observed in a large part of clinical EEG data. Through the SHapley Additive exPlanations (SHAP) method, the framework also combines the principles of Explainable Artificial Intelligence (XAI) in providing clinical decision support model predictions that are transparent and interpretable. With an overall detection accuracy of 99%, experimental validation on benchmark EEG datasets is able to demonstrate better results compared to traditional techniques. An important step towards intelligent, interpretable, and trustworthy stroke detection is represented by the suggested IoT-enabled intelligent system, which assists with the effective diagnosis and real-time patient monitoring, as is the case in contemporary clinical settings.

Keywords: Stroke Detection, Hybrid Deep Learning, Gated Recurrent Unit (GRU), Medical Data Balancing, Real-Time Clinical Monitoring.

CSP02

Manuscripts character recognition using machine learning and Deep learning

Jayapriya M[1] and Lalitha S[1*]

[1,1*]Department of Computer science, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Theautomaticcharacterrecognitionofhistoricdocumentsgainedmoreattentionfromscholarsrecently,duetothebigimprovementsincomputervision,imageprocessing,anddigitization.WhileNeural Networks,thecurrentstate-of-the-artmodelsusedforimagerecognition,arevery performant,theytypicallysufferfromusinglargeamountsoftrainingdata.Inourstudywemanuallybuiltourownrelativelysmalldatasetof404charactersbycroppingletterimagesfromapopularhistoricmanuscript,theElectronicBeowulf.TocompensateforthesmalldatasetweuseImageDataGenerator,aPythonlibrarywasusedtoaugmentourBeowulfmanuscript’sdataset.Thetrainingdatasetwasaugmentedonce,twice,andthrice,whichwecallresampling1,resampling2,andresampling3,respectively.Toclassifythemanuscript’scharacterimagesefï¬ciently,wedevelopedacustomizedConvolutionalNeuralNetwork(CNN)model.Weconductedacomparativeanalysisoftheresultsachievedbyourproposedmodelwithothermachinelearning(ML)modelssuchassupportvectormachine(SVM),K-nearestneighbor(KNN),decisiontree(DT),randomforest(RF),andXGBoost.Weusedpretrainedmodelssuchas VGG16,MobileNet,andResNet50toextract featuresfromcharacterimages.Wethentrainedandtestedtheabove ML models and recorded the results.Moreover,wevalidatedourproposedCNNmodelagainstthewell-establishedMNISTdataset.OurproposedCNNmodelachievesverygoodrecognitionaccuracies of 88.67%,90.91%,and98.86%inthecasesofresampling1,resampling2,andresampling3,respectively,fortheBeowulfmanuscript’sdata.Additionally,ourCNNmodelachievesthebenchmarkrecognitionaccuracyof99.03%fortheMNISTdataset.

Keywords: Automatic Character Recognition (ACR), Convolutional Neural Network (CNN) , Data Augmentation (ImageDataGenerator), Historic Manuscript (Electronic Beowulf) , Pretrained Models (VGG16, MobileNet, ResNet50)

CSP03

Multimodal Knee Tumor Diagnosis Using Attention-Weighted Swin Transformer and Radiomics-Based Deep Feature Fusion

Janaki G[1] and Umanandhini D[1*]

[1,1*]Department of Computer Science, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Accurate classification of knee tumors from magnetic resonance imaging (MRI) remains challenging due to heterogeneous tumor appearance, complex anatomical structures, and overlapping imaging characteristics between malignant and benign tissues. While convolutional neural networks (CNNs) effectively capture local texture patterns, they often struggle to model long-range contextual dependencies that are critical for reliable tumor characterization. Conversely, radiomics descriptors provide interpretable quantitative tissue features but lack adaptive representation learning capability. To address these limitations, this paper proposes an attention-guided multimodal CNNâ€“Transformer framework that jointly leverages deep MRI features and handcrafted radiomics information for robust knee tumor classification. Specifically, an Attention-Weighted Swin Transformer Module (AWSTM) is introduced to learn hierarchical and global contextual representations from MRI slices through window-based self-attention enhanced with channel and spatial refinement. In parallel, a lightweight Radiomics CNN Encoder (RCE) models structured quantitative descriptors and captures inter-feature correlations. An attention-guided fusion mechanism adaptively integrates both modalities by recalibrating MRI features using radiomics-informed gating, enabling complementary anatomical and statistical information to be effectively combined. Extensive experiments demonstrate that the proposed framework consistently outperforms radiomics-only, CNN-based, and transformer-only baselines. The model achieves an overall accuracy of 94.3%, F1-score of 94.0%, and AUC of 97.8%, with balanced performance across all tumor classes. These results indicate that integrating transformer-based global context modeling with radiomics-driven quantitative analysis provides a robust and clinically meaningful solution for automated knee tumor diagnosis.

Key words: Knee tumor classification, Magnetic resonance imaging (MRI), Radiomics, Swin Transformer, Attention mechanism, Multimodal deep learning, Feature fusion, Computer-aided diagnosis (CAD)

CSP04

Deterministic Lifecycle Security Framework for RFID-XRF Gold Asset Tracking

Sakthi J[1] and Manoharan S N[1*]

[1,1*]Department of Computer Science, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

High-value assets such as gold bullion need strict workflow monitoring and tracking, across heterogeneous devices. Gold asset tracking can be done through RFID tags and its purity can be verified by XRF analyzers, still they lack to maintain correct execution of events and can invite logical attacks. This paper proposes a FSM-based lifecycle framework with stages for gold asset, that follows deterministic approach for event execution. This allows RFID and XRF-based events to occur in sequential order rejecting replay, out-of-order execution, and substituting different asset. A SeqID (Sequence ID) based session binding is introduced to securely map XRF purity reports with their corresponding RFID attached assets without hardware modification of existing devices. The framework is implemented as server-side enforcement engine and tested using simulated normal and adversarial workflows. Experimental results show that all injected logical attack scenarios were rejected at execution time with negligible latencies. This proves that FSM-based enforcement operates as reliable and efficient approach for securing high value assets.

Key words: RFID Asset Tracking, Event-driven Systems, Finite State Machine, Workflow Enforcement

CSP05

LSTM-Based Intelligent Traffic Congestion Forecasting for Indian Urban Networks

Mahalakshmi D[1] and Kanimozhi Suguna S[1*]

[1,1*] Department Computer Science, SRM Institute of Science and Technology.

Abstract

Rapid urbanization and exponential vehicle growth have intensified traffic congestion in Indian cities, particularly under heterogeneous and non-lane-disciplined conditions. Accurate short-term traffic prediction is essential for proactive traffic management and congestion mitigation. This paper proposes a data-driven framework using a Long Short-Term Memory (LSTM) network to model temporal traffic dynamics and forecast congestion levels. The model leverages historical traffic flow, speed, and occupancy data through a sliding window time-series approach to capture nonlinear temporal dependencies. Designed for mixed-traffic urban environments, the proposed system supports real-time congestion monitoring, adaptive traffic signal planning, and route advisory applications. By integrating predictive intelligence into traffic management systems, the framework enables informed decision-making for smart mobility infrastructure. The approach provides a scalable foundation for deploying AI-driven traffic forecasting solutions across rapidly growing urban networks.

Key words: Artificial Intelligence, Urban Traffic Prediction, Long Short-Term Memory (LSTM), Mixed-Traffic Conditions, Smart Cities, Real-Time Congestion Monitoring, Time-Series Forecasting, Intelligent Transportation Systems, Adaptive Traffic Management, Urban Mobi

ITT01

AI-Assisted Framework for Dynamic and Cryptic Binding Pocket Detection Using Molecular Dynamics

Saranya S[1] and Suresh Kumar C[1*]

[1,1*]Department of Information Technology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Identification of druggable binding pockets is a critical step in structure-based drug discovery. Conventional pocket detection methods rely on static protein structures and often fail to capture cryptic or transient pockets that emerge due to protein conformational dynamics. To address this limitation, we propose an AI-assisted computational framework for dynamic and cryptic binding pocket detection using molecular dynamics (MD) simulations. The proposed framework integrates MD simulations to generate conformational ensembles of target proteins, followed by automated pocket detection and AI-assisted feature analysis across multiple dynamic frames. Extracted pockets are quantitatively evaluated using structural and temporal descriptors such as pocket volume, persistence, and evolution patterns to identify dynamically stable and cryptic binding sites. Custom scripting and visualization workflows are employed to track pocket behavior over time and compare static and dynamic pocket landscapes. The system has been implemented and validated in a controlled computational environment using real protein structures. Experimental results demonstrate effective identification of transient binding pockets through pocket evolution analysis, volume variation profiling, and persistence heatmaps, with improved coverage compared to static structure-based methods. This validation corresponds to Technology Readiness Level (TRL) 3â€“4. The proposed framework enhances early-stage drug discovery by providing a more realistic representation of protein druggability and can be extended for docking-based screening and AI-driven pocket prioritisation.

Key words: Dynamic Pocket Detection, Cryptic Binding Sites, Molecular Dynamics Simulation, AI-Assisted Framework, Structure-Based Drug Discovery, Protein Druggability, Computational Biology

BMP01

MSA U-Net: A Dual-Scale Mining Self-Attention Network for Accurate Segmentation in Echocardiographic Images for MI Diagnosis

Anushalin P S[1] and Arunachalam P[1*]

[1,1*]Department of Biomedical Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Accurate segmentation of cardiac structures from echocardiographic images is essential for the quantitative assessment of heart function. However, the low contrast, noise, and complex structure make the segmentation process more challenging. Recently, deep learning models with attention mechanisms have been widely used for segmentation. However, there is still room for improvement in boundary areas. To overcome the boundary segmentation problem, we propose a novel Dual- Scale Mining Self-Attention U-Net (DS-MSA U-Net) architecture that effectively addresses boundary issues by integrating multi- scale feature extraction, mining modulation, and self-attention mechanisms into the conventional U-Net model. The proposed Mining Self-Attention (MSA) module dynamically modulates the self-attention computation by incorporating a learned mining map, which highlights spatial regions of high uncertainty in cardiac boundaries and noise-affected areas. This mining map is derived from feature-level statistics, such as variance or estimated uncertainty, and is used to control both the query and key representations within the self-attention computation. In order to better represent features, at every level of the network a dual-scale extraction module is employed to obtain contextual information at different receptive fields and enhance the border delineation of cardiac chambers like the left ventricle and myocardium. The incorporation of multi-scale learning here guarantees that both global shapes and fine boundary details are maintained. Experimental assessments performed using publicly available echocardiography datasets confirm that the proposed DS-MSA U-Net performs better than baseline and state-of-the- art models. Having greater segmentation accuracy, the proposed approach presents a promising solution for accurate automated cardiac image analysis in clinical settings

Key words: Deep learning, Attention, Segmentation, ECHO images,myocardial infarction

BTP01

Tri-functional role of phosphoric acid for seaweed hydrolysis and microbial fermentation

AnbuChezhiyan Elango[1] and Mugesh Sankaranarayanan[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Green seaweed (Chaetomorpha antennina) was explored for its potential to be used as a carbon source for microbial cultivation. For this, the green seaweed biomass was acid thermal hydrolyzed to obtain nutrient rich hydrolysate. This seaweed hydrolysate containing fermentable sugars has been formulated into a medium along with the supplementation of minimal media components. During storage, the seaweed-derived medium exhibited agglomeration and sedimentation. In detailed investigation, it was observed that the presence of phosphate salts in the buffer leads to agglomeration. To address this, HEPES was used as an alternative buffer. But the absence of phosphate sources in the media significantly reduces the growth and cellular metabolism of the strains cultivated in the media. Therefore, it is crucial to add a phosphate source in the media. To overcome these issues, phosphoric acid (H3PO4) used as a hydrolyzing agent, whereas KOH was used as a neutralizing agent. These acid base reactions create phosphate salts as well as acts as a buffer. Thus, phosphoric acid serves as a tri-functional catalyst offering a stable, efficient and nutrient-rich medium for microbial applications.

Key words: Seaweeds, Acid thermal hydrolysis, Phosphoric acid, fermentable sugars, E. coli

BTP02

An Integrated Biorefinery Approach for Dual Recovery of Phlorotannins and Fermentable Sugars from Sargassum wighitii and Padina tetrastromatica

Uthesh Ragavan[1], Mugesh Sankaranarayanan[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Phlorotannins, a unique class of polyphenolic compounds commonly found in brown seaweeds, have emerged as promising candidates for pharmaceutical and nutraceutical applications due to their diverse bioactivities. In the present study, phlorotannins were extracted from brown seaweeds Sargassum wighitii and Padina tetrastromatica using the ultrasound-assisted extraction method, and the extraction parameters were systematically optimised through response surface methodology (RSM) employing a Boxâ€“Behnken design. The model enabled precise evaluation of solvent concentration, solid-to-liquid ratio, and temperature, identifying conditions that significantly enhanced phlorotannins recovery. The optimised extracts were subjected to HPLC analysis for characterisation. In vitro biochemical assays revealed strong antioxidant capacity. On the other hand, the fermentable sugar extraction from phlorotannins extracted residual biomass by acid thermal hydrolysis (ATH) for bacterial strain valorization. This study demonstrates an integrated approach combining green extraction strategies with analytical and bioassay techniques to maximise the yield and therapeutic efficacy of marine phlorotannins. The findings not only provide a foundation for the sustainable utilisation of seaweed-derived bioactives but also underscore their potential as multifunctional agents in the pharmaceutical sector.

Keywords: Phlorotannins, Sargassum wighitii, Padina tetrastromatica, ultrasound-assisted extraction, antioxidant and acid thermal hydrolysis.

BTP03

Utilization of *Sapindus mukorossi* as a Sustainable Biopesticide: Ecotoxicological Assessments and Development of Hydrogel Solutions

Zubair Ahamed Shaik[1] and Azhagu Saravana Babu P[1*]

[1]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Sapindus mukorossi, commonly known as soapnut, is recognized for its saponin-rich fruit that exhibits significant insecticidal, antibacterial, and antifungal properties, highlighting its potential as a sustainable biopesticide. This study investigates the in silico larvicidal activity and ecotoxicity of *S. mukorossi*, followed by the development of a novel biopesticide formulated with hydrogel incorporation. Characterization of methanolic extracts via GC-MS identified key phytocompounds, such as mome inositol, glycidyl palmitate, and 5-hydroxymethylfurfural. Molecular docking studies demonstrated strong binding affinities of mome inositol and butyl acetoxyacetate with Acetylcholinesterase from Drosophila melanogaster, indicating pronounced insecticidal efficacy. Ecotoxicological assessments using *Allium cepa* and *Eisenia fetida* showed dose-dependent phytotoxicity at higher concentrations (500 ppm) and minimal effects at lower concentrations (â‰¤125 ppm). The *E. fetida* tests revealed low toxicity, with an LCâ‚…â€€ of 88,345.65 ppm, thus confirming environmental safety. Incorporation into a sodium alginate-based hydrogel was validated through FTIR and SEM analyses.

Keywords: *Sapindus mukorossi*, Soap nuts, ecotoxicity, *Allium cepa*, *Eisenia fetida*, hydrogel

BTP04

Microbial Synthesis of Prodigiosin by Actinomycete Spp.: Characterization and Functional Applications

Sakthi Priyanka P[1] and Sai Nandhini R[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Prodigiosin, red tripyrrolic pigment, recognized for its diverse therapeutic properties and growing potential in pharmaceutical and industrial applications. In this study, a novel prodigiosin-producing microorganism was isolated from Paddy field soil and characterized, and molecular analyses, including 16S rRNA gene sequencing, confirmed the taxonomic affiliation of the isolate within the Actinomycetes group. Pigment production was carried out under controlled conditions, followed by ethanol-based extraction. The extracted pigment was purified and characterized using UVâ€“visible spectroscopy, High-performance liquid chromatography (HPLC), Fourier-transform infrared spectroscopy (FTIR). The UV spectrum exhibited absorption maximum at 531 nm, while HPLC analysis showed dominant peak at a retention time of 6.5 min, indicating high purity. FTIR spectra confirmed presence of functional groups consistent with prodigiosin, validating pigment identity. Molecular docking studies were conducted against cancer and inflammation-associated targets, including ERÎ±, EGFR-TK, BRAF V600E, AKT1, Î²-catenin, and IL-6, revealing strong binding affinities and bioactivity. The biological potential pigment was evaluated through a range of in vitro assays. Prodigiosin exhibited strong antioxidant activity with an ICâ‚…â‚€ value of 63.28 Âµg/mL and antibacterial activity against both Gram-positive and Gram-negative bacteria. Notable inhibition was observed against Lactococcus lactis, Bacillus spp., Klebsiella pneumoniae, and Escherichia coli. Additionally, the pigment demonstrated significant anti-inflammatory activity (42.96%), pronounced antidiabetic potential through Î±-amylase inhibition (53.80%), and dose-dependent cytotoxicity against the MCF-7 breast cancer cell line. Overall, this study underscores the multifunctional biological potential of prodigiosin derived from a novel Actinomycete, highlighting its promise for pharmaceutical and biotechnological applications.

Keywords: Prodigiosin, Actinomycetes spp., Extraction, Antidiabetic, Anticancer.

BTP05

MRI Reimagined: Safe, Scalable, and Sustainable Dual Contrast Green SPIONs

Varuna Kumaravel[1], Senthil Kumar S[1*]

[1,1*]PG & Research Department of Biotechnology, National College (Autonomous), Tiruchirappalli.

Abstract

Magnetic Resonance Imaging (MRI), a proficient molecular imaging technique with high spatial resolution, soft-tissue imaging capability, and non-invasiveness, suffer from background signals that affect the image contrast sensitivity. Several contrast enhancers produced to modulate the longitudinal (r1) and the transverse relaxivity values (r2) were proven to cause Nephrogenic Systemic Fibrosis (Gd-based systems). In this regard, iron oxide nanoparticles (IONPs) was developed as dual-mode contrast agent (both T1 and T2) using banana flower perianth as the structure-directing template without additional chemical/ physical agents. This was made possible by the pores in the perianth surface, which act as the microreactors where the synthesis takes place. Primarily, the optimization of the size and shape of the nanoparticles have been emphasized that resulted in nanosphere morphology as observed from SEM and TEM analyses. XPS and VSM studies revealed that the IONPs are in their multivalent oxidation state and are superparamagnetic. The MR images of phantom agar gels with IONPs revealed their dual contrast property. Further, HEK 293 cell lines retained their viability even at higher doses of IONPs. Also, the colloidal stability of IONPs was proven to be excellent through SEM analysis post-incubation in PBS buffer. Thus, the study highlights the efficiency of template-synthesized nanoparticles as dual-mode contrast agents for MRI.

Keywords: MRI, dual contrast agents, iron oxide, templated synthesis, and agro-waste

BTP06

Sustainable Collagen-Cellulose Composite Bio hydrogels derived from Waste Biomass for Climate Smart Soil Conditioning and Agricultural Resilience

Ramnath R[1] and Hariharan N M[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

This study presents the extraction, characterization, and proposed agricultural applications of two waste-derived biopolymers, collagen from enzyme-treated goat skin and cellulose from banana pseudostem residues. Collagen, a biodegradable structural protein sourced from leather industry by-products, offers significant potential as a sustainable soil amendment due to its inherent biodegradability, nitrogen-rich composition, and compatibility with soil microbial communities. Cellulose recovered from banana agricultural waste provides a renewable, structurally stable polysaccharide with exceptional water absorption capacity and environmental sustainability credentials. Comprehensive structural characterization was performed for both substances using Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), and Nuclear Magnetic Resonance (NMR) spectroscopy. FTIR analysis confirmed characteristic functional groups in both biopolymers, while SEM revealed a porous fibrillar morphology in cellulose suitable for three-dimensional hydrogel network formation. NMR spectroscopy validated collagen molecular conformation and purity, confirming successful extraction while preserving essential structural integrity required for biomaterial applications. Based on these characterization results, a biodegradable collagenâ€“cellulose composite hydrogel system is proposed for sustainable agriculture with multiple functional applications. The proposed composite hydrogel can serve as an advanced soil conditioner by significantly improving moisture retention capacity in soil, regulating water availability during drought stress, and enhancing soil structure and aeration. Additionally, it functions as a controlled-release fertilizer carrier matrix, particularly for nitrogen-based fertilizers such as urea, enabling gradual nutrient release synchronized with crop uptake patterns. While simultaneously reducing environmental losses through leaching, ammonia volatilization, and surface runoff. The biodegradable nature of both biopolymers offers an environmentally superior alternative to synthetic petroleum-based superabsorbent polymers and polymer-coated fertilizers. This approach promotes waste valorizations, circular bioeconomy principles, and resource efficiency, demonstrating strong potential for developing next-generation sustainable agricultural technologies supporting soil health, water conservation, and climate-resilient crop production systems.

Keywords: Collagen cellulose hydrogel, Waste-derived biopolymers, Sustainable agriculture, Controlled-release fertilizer, Soil moisture retention.

BTP07

Comparative Wound Healing Efficiency of Curcuma longa Extract and Isolated Curcumin: An In-Vitro Study.

Yuvarani K[1] and Shobana Sampath[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Turmeric, scientifically known as Curcuma longa, has traditionally been considered a medicinal plant. One of the most common uses of turmeric is for treating wounds. Because of its bioactive potential, Lakadong turmeric, grown in Meghalaya, has been the source of more scientific interest due to its high content of curcumin. The study examined the phytochemical analysis, biological activities, and systematic extraction of Lakadong turmeric from Tamil traditional medicine. Phytochemical profiling of the crude extract was done using a series of UV-Visible spectroscopy, FTIR, and LC-Mass Spectrometry. Compounds detected have been found to be rich in phenolic and flavonoid contents. A quantitative estimation showed a very high level of total phenolic content (TPC) and total flavonoid content (TFC), which confirms the antioxidant capacity of the extract. Antioxidant activity was quantified with free radical scavenging assays, while anti-inflammatory activity was assessed in an in-vitro protein denaturation method; both attributes showed bioactivity which was concentration-dependent. The encouraging results motivated the investigation of the main active compound by chromatographic techniques. Elaborative characterization of the isolated compound is currently in progress with the help of advanced analytical tools. The preliminary in-vitro wound healing study performed through a scratch assay demonstrated that extract has a positive impact on cell migration and this would provide evidence to suggest a stimulation in the tissue regeneration process.

Keywords: Lakadong turmeric; Curcuma longa; Phytochemical profiling; Antioxidant activity; Anti-inflammatory activity; Wound Scratch assay.

BTP08

Functional Screening of Potential Probiotic Bacteria from Fermented Foods

Yuganthra B[1] and Sai Nandhini R[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Probiotics are live microorganisms that confer health benefits to the host when administered in adequate amounts. Traditional fermented foods serve as rich reservoirs of diverse lactic acid bacteria (LAB), yet many indigenous strains remain insufficiently explored beyond preliminary isolation. The present study aimed to isolate and functionally screen potential probiotic strains from idly batter and establish a framework for their application in probiotic-rich food and feed development. A total of 25 bacterial isolates were obtained from idly batter and maintained on MRS agar medium. Preliminary screening included lactic acid production assay, catalase test, and acid tolerance evaluation. Seventeen isolates demonstrated clear zone formation on MRS-CaCO agar, confirming lactic acid production. Catalase testing was performed for preliminary differentiation of LAB characteristics. Acid tolerance was assessed under simulated gastric conditions (pH 3 for 3 hours), where most isolates maintained viable counts above 10â· CFU/mL. Strains IB1, IB2, IB5, IB7, IB8, IB18, IB20, IB23, and IB25 exhibited high acid tolerance, while IB3 and IB6 showed comparatively lower survival. These findings indicate that several indigenous isolates possess promising probiotic attributes. The shortlisted strains will undergo further functional characterization including bile tolerance, antimicrobial activity, safety assessment, and molecular identification (16S rRNA sequencing). The study aims to translate validated strains into functional food formulations. This research contributes to expanding strain diversity and improving the translational potential of indigenous probiotic candidates for functional food.

Keywords: Probiotics, Indigenous lactic acid bacteria, Functional food, Acid tolerance, Lactic acid production.

BTP09

Anti-Arthritic Nanogel Therapy Derived from Calotropis gigantea Leaf extract

Karthik R[1] and Achsah R S[1*]

[1]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Rheumatoid arthritis is a progressive autoimmune disorder characterized by chronic synovial inflammation and joint destruction, necessitating safer and more effective therapeutic strategies. The present study investigates the development of a chitosan-based nanogel incorporating Calotropis gigantea leaf extract for enhanced anti-arthritic efficacy. The leaves were subjected to solvent extraction followed by preliminary phytochemical screening and quantitative estimation of major secondary metabolites. The extract was encapsulated into chitosan nanoparticles using the ionic gelation method to improve stability, bioavailability, and controlled release characteristics. The optimized nanoparticles were formulated into a topical nanogel and evaluated for physicochemical properties, particle size distribution, encapsulation efficiency, and in vitro drug release behavior. Anti-arthritic activity was assessed in an experimental rat model of arthritis by measuring paw edema, arthritic scoring, and biochemical inflammatory markers. The nanogel formulation exhibited superior suppression of inflammatory symptoms compared to untreated arthritic controls, indicating enhanced therapeutic performance. The improved efficacy is attributed to nanoscale delivery, sustained release kinetics, and improved penetration of bioactive phytoconstituents. These findings suggest that Calotropis gigantea-loaded chitosan nanogel represents a promising phytopharmaceutical approach for managing inflammatory arthritis and warrants further pharmacodynamic and mechanistic investigations.

Key Words: Calotropis gigantea; Chitosan nanoparticles; Nanogel formulation; Anti-inflammatory activity; Experimental arthritis model

BTP10

Banana Pistil Biotemplated CaO-Alginate Composite Beads as a Recyclable Photocatalyst for UV-Driven Degradation of Naphthalene

Singaraju Revathi [1] and Jagajjanani Rao K[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

A sustainable CaO-biopolymer hybrid photocatalyst was fabricated using a green biotemplating strategy for the efficient degradation of naphthalene under UV irradiation. Banana blossom pistils were employed as a renewable biological scaffold to immobilize CaÂ²âº ions and promote in situ formation of Ca(OH), which upon calcination (900 Â°C, 0.5 h) yielded phase-pure CaO nanoparticles. The resulting biotemplated CaO nanoparticles were subsequently immobilized within a calcium alginate matrix via ionic gelation, forming mechanically robust spherical beads with diameters of 2.5-3.0 mm. Structural and spectroscopic analyses (XRD, FTIR, UV-vis, SEM-EDS) confirmed the formation of crystalline CaO nanoparticles (20-50 nm) uniformly distributed within the alginate network, with strong interfacial interactions between the inorganic and polymeric phases. The CaO-alginate composite beads exhibited high photocatalytic activity toward aqueous naphthalene (30 mg Lâ»Â¹), achieving over 85% degradation in the initial cycle under UV (254/365 nm) irradiation and following pseudo-first-order kinetics (kapp = 0.0164 minâ»Â¹; t1/2 â‰ˆ 42 min). GC-MS analysis revealed the formation of oxidized intermediates, including aromatic acids and long-chain fatty acids, indicating hydroxyl and superoxide radical-mediated ring-opening pathways. Importantly, the composite retained 60-63% of its initial activity after 10 successive cycles, significantly outperforming unsupported CaO and previously reported oxide-based photocatalysts. Post-reaction FTIR and spectroscopic studies suggest that activity loss originates primarily from surface fouling by strongly adsorbed carboxylates and carbonaceous residues rather than structural degradation. The alginate matrix provides multivalent stabilization through ionic coordination, hydrogen bonding and steric confinement, preventing nanoparticle aggregation and bead fragmentation during repeated use. Overall, this work demonstrates facile route synthesized biotemplated CaO-alginate photocatalyst with enhanced durability and reusability, offering a promising green materials platform for the remediation of persistent organic pollutants.

Keywords: Green synthesis, Sustainable route, Calcium oxide, Composites, Naphthalene degradation

BTP11

ACC Deaminase- Mediated Suppression of Stress Ethylene for Improving Plant Growth and Disease Tolerance Under Waterlogging

Elakkiya[1] and Achsah R S[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Floods and waterlogging severely limit agricultural productivity in India, affecting nearly 11.6 million hectares annually and causing significant yield losses in major rainfed crops. Waterlogging induces hypoxic soil conditions that disrupt root metabolism and trigger excessive accumulation of the stress hormone ethylene via increased levels of its precursor, 1-aminocyclopropane-1-carboxylate (ACC). Elevated ethylene concentrations inhibit root elongation, reduce nutrient uptake, accelerate senescence, impair photosynthesis, and enhance susceptibility to soil-borne pathogens, thereby compounding crop losses. This study proposes a sustainable, microbe-mediated strategy to mitigate waterlogging stress using ACC deaminase-producing plant growth-promoting rhizobacteria (PGPR). These beneficial bacteria degrade ACC into Î±-ketobutyrate and ammonia, thereby lowering stress-induced ethylene levels and restoring hormonal balance in plants. In addition to ethylene regulation, selected rhizobacterial strains exhibit multiple growth-promoting traits, including indole-3-acetic acid production, phosphate solubilization, siderophore production, and nitrate reduction, which collectively enhance root architecture, nutrient acquisition, antioxidant activity, and disease resistance under hypoxic conditions.involves isolation and characterization of ACC deaminase-producing rhizobacteria from red soils, screening for stress tolerance, and evaluation of plant physiological, biochemical, and disease responses under controlled waterlogging conditions through glasshouse and preliminary field trials. The development of standardized inoculum production and seed-coating techniques ensures effective root colonization and reproducible performance.

Keywords: Waterlogging stress; ACC deaminase; Plant growth-promoting rhizobacteria (PGPR); Ethylene regulation; Climate-resilient agriculture.

BTP12

Development of Plant based Leather using Chitosan - Alginate Biopolymer composites

Anjali Mishra[1] and Tarangini Korumilli[1*]

[1,1*]Centre of Biomaterials and Environment, Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology Chennai-600062, Tamil Nadu, India

Abstract

The growing environmental and ethical concerns associated with conventional animal leather, along with the non-biodegradability and toxicity of PU/PVC-based synthetic alternatives, have significantly accelerated the search for sustainable vegan leather materials. However, studies on plant fiber-reinforced polysaccharide-based sheets suitable for leather-like applications remain limited. The present work reports on the development of fully bio-based composite sheets by incorporating plant fibers into a chitosan-alginate polymer matrix using a simple aqueous processing route. The resulting composites exhibited enhanced tensile strength and improved flexibility compared to the neat polymer matrix, indicating effective stress transfer between the fibers and the biopolymer network. Fourier transform infrared (FTIR) spectroscopy confirmed strong intermolecular interactions between the plant fibers and the chitosan-alginate matrix. While the scanning electron microscopy (SEM) revealed uniform fiber dispersion and good interfacial adhesion. The developed composite sheets are entirely bio-based, solvent-free, and biodegradable, demonstrating their potential as sustainable substrates for next-generation vegan leather applications.

Keywords: Plant fibre, Chitosan- Alginate, Vegan leather, Biodegradable composites, Sustainable materials.

BTP13

Phytochemical-Mediated Diabetic Wound Healing: Therapeutic Potential of Momordica charantia

Nandha Kumar[1] and Sugumari vallinayagam[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Diabetic wounds are characterized by delayed healing due to excessive oxidative stress, chronic inflammation, impaired angiogenesis, and reduced collagen synthesis. Medicinal plants rich in bioactive phytochemicals provide a promising alternative for effective wound management. The present study aimed to investigate the wound healing potential of Momordica charantia extract and its chitosan nanoparticle formulation through qualitative and quantitative phytochemical analysis and in vivo evaluation using a diabetic rat wound model. Plant material was extracted using suitable solvent extraction methods and subjected to preliminary qualitative phytochemical screening to identify major secondary metabolites such as flavonoids, phenolic, alkaloids, saponins, and triterpenoids. Quantitative estimation of total phenolic and flavonoid contents was performed using standard spectrophotometric assays. The extract was incorporated into chitosan nanoparticles by the ionic gelation technique to improve stability, bioavailability, and controlled release of phytoconstituents. Diabetes was induced in rats, and excision wound models were created to assist wound healing efficacy. Animals were divided into control, crude extract-treated, chitosan nanoparticle-treated, and standard drug-treated groups. Wound contraction rate, epithelialization period, and histopathological parameters were evaluated to determine the progression of healing. The results demonstrated that Momordica charantia extract-loaded chitosan nanoparticles significantly enhanced wound contraction, collagen deposition, and re-epithelialization compared to the crude extract and untreated control groups. The improved therapeutic effect was attributed to the synergistic action of phytochemicals possessing antioxidant and anti-inflammatory properties along with the biocompatibility and sustained-release behaviour of chitosan nanoparticles. This study highlights the potential of phytochemical-loaded chitosan nanoparticles as an effective strategy for the management of diabetic wounds.

Keywords: Momordica charantia, Diabetic wound healing, Phytochemical analysis, Chitosan nanoparticles, Rat model

BTT01

Sustainable Natural Foaming Agents: Optimization and Wetting Studies of Multi-Plant Saponin Systems from Northeast India

Vani G Viswam[1] and Jagajjanani Rao K[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India.

Abstract

The global shift toward eco-friendly and dermal-compatible cosmetic products has accelerated the search for natural alternatives to synthetic surfactants. This study reports the formulation and optimization of multi-plant, saponin-rich natural foaming agents derived from five relatively underexplored plant species native to Northeast India, Albizia lucidior, Albizia chinensis, Acacia auriculiformis, Acacia pennata, and Gymnocladus assamicus. Individual hydrothermal extracts were comprehensively characterized using UV-Vis spectroscopy, FTIR, and foamability analyses. Ross Miles foam tests combined with critical micelle concentration (CMC) measurements confirmed pronounced surface-active behavior, with several extracts demonstrating superior foam stability compared to sodium lauryl sulfate (SLS). A Taguchi L8 orthogonal array design was employed to optimize extract combinations for enhanced wetting performance, using contact angle (CA) minimization as the primary response. The optimized formulation comprising ACB, AAP, AAL, and APB achieved a contact angle of 74.0Â°, closely aligning with the predicted value of 72.8Â°, with high statistical reliability (RÂ² = 99.7%). Beyond surface activity, the optimized formulation exhibited strong emulsification efficiency and notable biofunctional performance. Antibacterial activity evaluated through the zone of inhibition assay against Staphylococcus aureus demonstrated effective microbial suppression, supporting its relevance for cosmetic hygiene applications. Additionally, antioxidant potential assessed via the DPPH radical scavenging assay revealed significant free-radical inhibition, underscoring the formulation's protective and skin-beneficial attributes. Application studies on hair substrates further confirmed excellent wettability, with contact angles of 73.3Â° on virgin hair and 47.6Â° on bleached hair. Collectively, these findings establish the optimized multi-plant saponin system as a multifunctional, sustainable, and biologically active natural surfactant suitable for advanced cosmetic and personal care formulations.

Keywords: Saponin, Northeast India, Wetting, Sustainable Resources, Green Chemistry, Cosmetic application

BTT02

Formulation and Physicochemical Characterization of an Herbal Microemulsion Containing Ocimum tenuiflorum and Hibiscus rosa-sinensis for advanced Hair care Application

Santhoshraman.B[1] and Jagajjanani Rao K[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India.

Abstract

The growing demand for sustainable and plant-based hair care solutions has intensified the need for advanced delivery systems capable of enhancing the stability and bioavailability of herbal actives. In the present study, methanolic leaf extracts of Ocimum tenuiflorum and Hibiscus rosa-sinensis were investigated as multifunctional bioactive compounds for advanced hair care formulations. Phytochemical profiling by GC-MS revealed a diverse spectrum of phenylpropanoids, terpenoids, fatty acids, triterpenoids and phytosterols associated with hair and scalp health. In silico SWISS-ADME analysis of major constituents indicated favourable topical pharmacokinetics and strong suitability for lipid-based nanocarriers, supporting their rational formulation design. An innovative herbal microemulsion was developed to address contemporary challenges of solubility, stability and controlled delivery of herbal actives. The optimized formulation exhibited nanoscale droplet size (â‰ˆ149 nm), high colloidal stability and a positive surface charge (+33.11 mV) indicating enhanced skin and hair follicle interaction. Furthermore, the microemulsion demonstrated dose-dependent antibacterial activity against Staphylococcus aureus highlighting its potential role in maintaining scalp hygiene. Overall, this study presents a time-relevant nanotechnology enabled strategy for the effective delivery of synergistic Ocimum-Hibiscus bio actives, positioning herbal microemulsions as promising platforms for advanced multifunctional hair care applications.

Keywords: Ocimum tenuiflorum; Hibiscus rosa-sinensis; GC-MS; SWISS ADME; herbal microemulsion; advanced hair care.

BTS01

From Plant Waste to Functional Bio interfaces: Extraction, Characterization, and Biomedical Applications of Cellulose Nanocrystals

Aisha Halliru Duwan[1] and Achsah R S[1*]

[1,1*]Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Agricultural and industrial plant wastes generate over 140 billion tons of biomass annually, representing an underutilized feedstock for sustainable nanomaterial production. Cellulose nanocrystals (CNCs) derived from plant-based agricultural wastes have emerged as promising multifunctional candidates, aligning biomedical material development with circular bioeconomy principles. This review critically examines recent advances (2020-2025) in the extraction, synthesis, and biomedical applications of CNCs obtained from plant wastes, such as banana pseudostems, pineapple leaves, and other agro-residues. Emphasis is placed on pretreatment strategies, extraction methodologies, including mild acid hydrolysis, TEMPO-mediated oxidation, enzymatic treatments, and emerging green approaches, and their influence on CNC physicochemical properties. The review further analyzes characterization and functionalization strategies, particularly chemical functionalization and bioactive agent immobilization, which transform CNCs from passive reinforcing fillers into multifunctional biomedical platforms. Key biomedical applications, including wound dressings, drug delivery systems, and tissue scaffolds, are critically discussed with respect to structure-property-function relationships. Despite significant progress, challenges remain in feedstock variability, lack of standardized characterization protocols, limited in vivo validation, and process scalability. Finally, future research directions are proposed, emphasizing application specific CNC design, mechanistic bio-nano interaction studies, and sustainable processing routes. This review provides a comprehensive framework for advancing plant-derived CNCs toward clinically and industrially relevant biomedical applications.

Keywords: Cellulose nanocrystals, plant waste, green extraction, biomedical applications, wound dressing, drug delivery, sustainable nanomaterials

EEEP01

Real-Time Fault Detection and Partial Shading Prediction in Photovoltaic Systems using LSTM-Enabled IoT Framework

Habibu Murtala Abdullahi[1] and Sivakumar S[1*]

[1,1*]Department of Electrical and Electronical Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

The occurrence of partial shading (PS) in photovoltaic (PV) systems has a profound impact on their operational performance, as it triggers the formation of hotspots, ultimately resulting in accelerated losses and irreversible damage to the PV module. To address power degradation caused by PS, it is essential to accurately detect PS and intensity-related features. This research presents an innovative Internet of Things (IoT)-enabled Long Short-Term Memory (LSTM) framework for proactive PS detection, classification, and short-term prediction in PV array. In contrast to conventional reactive approaches that detect shading events after their occurrence, the proposed three-stage methodology facilitates anticipatory shading management through the voltage time-series analysis. The framework integrates rule-based detection algorithms with advanced deep temporal learning architectures, utilizing cost-effective IoT sensors to mitigate reliance on external imaging systems or intricate meteorological setups. Experimental validation reveals outstanding performance across all operational stages: 99.05% detection accuracy, 95.51% classification precision for dynamic and static shading patterns (SPs), and superior prediction capability with an RÂ² value of 0.932 and a Mean Absolute Error (MAE) of 1.349V for short-term intensity forecasting. The proposed approach offers dual advantages of real-time monitoring and precise shading classification, thereby enabling a transition from conventional reactive fault detection strategies toward proactive and predictive management, while enhancing energy efficiency and operational reliability under dynamic environmental conditions.

Keywords: Internet of things (IoT); Fault detection; Photovoltaic systems; Partial shading; LSTM networks; shading patterns (SPs).

EEET01

INTEGRATED RENEWABLE ENERGY SYSTEM FOR ELECTRIC VEHICLES UTILIZING A PV FED THREE PHASE SYNCHRONOUS RELUCTANCE MOTOR AND HIGH GAIN DC DC CONVERTER

Jeevarathinam P R[1] and Vinoth K[1*]

[1,1*]Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

This research proposes an integrated approach to enhance electric vehicle EV performance and efficiency using renewable energy It combines a photovoltaic PV array with a high gain improved singleended primary inductor converter with Luo topology Integrated SEPIC Luo DC DC converter to optimize PV system output An African Buffalo Algorithm ABA optimized Artificial Neural Network ANN Maximum Power point tracking MPPT controller is introduced, which maximizes PV system power output by continuously adapting to environmental changes. Excess energy is stored in a supercapacitor via a bi directional converter, allowing for rapid storage and release as needed The EVs propulsion system features a three phase synchronous reluctance motor SyRM integrated with an n plus 1 diode and n plus1 semiconductor converter, with speed regulation by a Hysteresis controller based Proportional Integral PI controller for precise motor control The system also supplies excess energy to the grid through a single phase Voltage Source Inverter VSI enabling grid integration and renewable energy injection This integrated system optimizes PV system output enhances EV efficiency and contributes to sustainability and grid stability The tracking efficiency of the African Buffalo Algorithm ANN based MPPT is 98.85 percentage, whereas the efficiency of the proposed converter is 90 percentage. The simulation tool MATALAB was used for the whole evaluation.

Keywords: Integrated SEPIC-Luo converter, ABA optimized ANN controller, Hysteresis controller-based PI controller.

ECEP01

Performance Evaluation of a Slotted Circular Patch Antenna for Wi-Fi Applications

Kavitha M[1] and Aathmanesan T[1*]

[1,1*]Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

This design involves the optimization and design of a slotted circular antenna for Wi-Fi communications. An FR4 material of 1.6mm is used in the design, which is quite low-cost and has a partially grounded plane. To increase the current path length without increasing the physical length of the antenna, a horizontal slot is created inside the circular patch on the antenna. By using parametric optimization in Ansys HFSS, the design variables of the antenna were optimized. It is clearly evident after thorough analysis that the designed antenna has strong reflection coefficient values, stable gain patterns, high radiation patterns, and efficient Wi-Fi connectivity. There is almost constant gain realization of around -3.52 dBi in the antenna design that is adequate for short to medium-range Wi-Fi communication. Additionally, the E-plane and H-plane radiation patterns of the antenna are nearly omnidirectional patterns that offer excellent coverage. The surface current distribution analysis verifies that the slot geometry guides the flow of current effectively, hence allowing miniaturization as well as stability in performance. Overall, the slotted circular patch antenna is small in size, with robust performance and simple geometry, and hence it stands out to be a strong candidate for WiFi-based applications like wireless routers, IoT gateways, and wireless communication gadgets. Its design achieves the best optimality regarding the minimization of size, efficiency, manufacturability, and hence presents an economic solution toward wireless connectivity in this modern communication

Keywords: antenna, wi-fi, circular slot, small size, hfss, FR4 Substrate, copper, 2.4GHz,

ECEP02

Machine-Learning Aided - Geometry for High-Isolation Concentric Slot MIMO Antenna Targeting Sub-6 GHz 5G

Selvakani R[1] and Anto Bennet M[1*]

[1,1*]Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

This work introduces a concentric circular-slot multiple-input multiple-output (MIMO) antenna with machine learning support that uses a geometrical decoupling topology inspired by "A (à®…)" for Sub-6 GHz 5G applications. To achieve small size and efficient current redistribution, the suggested antenna combines an inner resonant element, a semi-circular radiator, and an outside circular radiating ring coupled by a central coupling strip. An annular and asymmetric slots are used in a geometry-driven decoupling technique to improve inter-element isolation even more. Critical geometrical parameters are optimized using a supervised machine learning regression model, which reduces computational cost in comparison to traditional parametric sweeps and allows for quick convergence toward ideal impedance matching and isolation performance. Achieving ultra-high isolation surpassing 20 dB, reflection coefficients below âˆ’10 dB, low envelope correlation coefficient (ECC), and attractive diversity gain characteristics, the simulation results show consistent operation across the intended Sub-6 GHz 5G bands. The suggested ML-assisted geometrical framework is ideally suited for next-generation 5G wireless terminals since it provides a scalable and effective method for designing compact high-isolation MIMO antennas.

Keywords: Machine learning, MIMO antenna, Concentric circular-slot geometry, High isolation, Sub-6 GHz 5G

ECEP03

A Low Phase Noise Phase-Locked Loop Architecture for Next-Generation Communication Applications

Priya P A[1] and Shiyamala S[1*]

[1,1*]Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Next-generation communication systems are evolving quickly, requiring highly stable frequency sources with minimal phase noise, a large tuning range, and low power consumption. The design and analysis of a low-phase-noise phase-locked loop (PLL) architecture for cutting-edge wireless communication platforms are presented in this study. The proposed PLL is appropriate for high-frequency applications, such as X-band systems, since it incorporates an optimized frequency synthesizer to produce accurate frequencies and enhance spectral purity. A varactor-tuned voltage-controlled oscillator (VCO), an effective charge pump, and a loop filter are used in the design to improve frequency stability and reduce reference spur effects and jitter. The PLL, which was designed with 14 nm CMOS technology and simulated in Synopsys, exhibits robust operation under process changes, rapid settling time, and dependable locking. Further, the proposed design satisfies the needs for multi-standard wireless communication. It works well with new Internet of Things (IoT) technologies that need high-performance, compact, and energy-efficient frequency synthesizers. Improved signal integrity and reduced interference are made possible by the low phase noise characteristics, which are essential for radar-based X-band applications and high-speed data communication.

Keywords: Phase-Locked Loop, Ring Oscillator, Frequency Divider, Charge Pump, Loop Filter, Phase Noise, Low Power Design

ECEP04

ML and DL based Combustion Flame Fuel Flow Prediction in a Thermal Power Station.

Sasikalareddy E[1] and SelwinMich Priyadharson A[1*]

[1]Department of Electronics and communication Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Thermal power station (TPS) provides a significant part for generating the electricity. The TPS require essential elements, which are fossil fuels, such as coal, oil, etc. Coal is burned to generate heat energy in the furnace. Hence, analysis of flame is very important when fuel combustion takes place in a furnace. Combustion quality plays an important role to reduce the wastage of fuel. The combustion quality of fuel is high which results in less wastage of fuel. As fossil fuels are more expensive in cost, in this work, combustion flame image is analyzed for real time measurement of combustion fuel flow in a TPS. The quality of combustion also depends on the flame temperature. The contents of the combustion diagnosis include temperature measurement and fuel flow prediction. This works main goal is to quantify the flame temperature and fuel flow using image processing and machine learning (ML) & deep learning (DL) techniques. This research manuscript represents the performance of ML and DL algorithms in predicting fuel flow. Finally, performances of those techniques are reviewed and compared on combustion flame image measurement and its analysis.

Keywords: Combustion flame image, combustion quality, flame temperature, ML temperature measurement.

ECEP05

Segmentation Of Plasmodium Falciparum Parasites In Blood Smear Images Using U-NET

Saranya R[1] and Bakiya A[1*]

[1]Department of Electronics and communication Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Malaria is a significant global health issue, leading to substantial illness and death in various regions of the world. Each year, millions of cases are recorded, making early detection and precise diagnosis essential for effective disease management and prompt treatment. The traditional method for malaria diagnosis has been the manual microscopic analysis of blood smears, widely regarded as the gold standard. Conducting manual microscopic examinations of blood smears is particularly challenging during large-scale screenings in rural regions. Therefore, an effective computer-assisted system is necessary for accurately identifying infected cells in blood smear images. In this study, a camera was utilized to capture images of thin blood smears infected with Plasmodium Falciparum. After staining the slides, samples of Plasmodium Falciparum were examined under a microscope. The quality of the blood smear images were collected to improved using Histogram Equalization (HE) techniques. Further, a Honey Badger Optimization based U-Net (HBA-UNet) was created to segment the infected cells in thin blood smear images of the Plasmodium Falciparum species. The effectiveness of the segmentation model was developed to compared the existing deep learning models such as MobileNet, EfficientNet, and U-Net. The results indicated that the dice coefficient for the HBA-UNet model reached a higher value of 96.07% compared to the other deep learning models. Further, the HBA-UNet model achieved recall, precision, accuracy, and IoU values of 90.93%, 91.26%, 98.77%, and 91.24% respectively, compare to other deep learning models. This outcome becomes the superior performance of the HBA-UNet model.

Keywords: Malaria,Histogram Equalization,Plasmodium Falciparum,U-Net,Honey Badger Optimization

AEP01

Integrated Static, Fatigue, and Modal Analysis of Bio-inspired Pineapple Leaf Fiber Composite Wings for Next Generation Micro Air Vehicles

Deeraj Balaji M[1] and VinothKumar M[1]

[1]Department of Aeronautical Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Significant attention has been given recently to natural fiber reinforced composites for being a sustainable alternative for aerospace synthetic materials due to low density, environmental compatibility, high specific strength and cost efficiency. Yet, a crucial gap remains in the understanding of structural performance when pineapple leaf fiber composites are used in aerospace components like micro air vehicle wings. Hence, this research develops a bio inspired MAV wing reinforced with surface treated PALF and epoxy resin. Minimal deformation, stress levels concentrated close to the fixed root and well distributed strain obtained through static structural analysis under realistic aerodynamic load confirms excellent load bearing capability. Uniform high fatigue life and high endurance limits throughout the wing obtained through fatigue analysis, indicates the suitability of the composite for cyclic aerodynamic loads. Modal analysis confirmed the wing dynamic stability by discovering six unique bending and coupled torsion bending mode geometries with suitably high natural frequencies, ensuring a safe separation from operational vibration ranges. Scanning electron microscopy was employed at multiple magnifications to examine the microstructural features of the composite, revealing strong fiber matrix bonding, crack deflection, and fiber pull out mechanisms. The novelty of this study lies in the overall integration of PALF reinforced epoxy into a fully modeled bio inspired wing, combining static, fatigue, and vibrational analysis establishes its structural viability. Overall, the results confirm that PALF epoxy composites offer a lightweight, sustainable, and mechanically reliable alternative for next generation UAV and MAV wing structures.

Keywords: Pineapple Leaf Fiber epoxy composites, Bio inspired wing, Micro Air Vehicle, Sustainable aerospace materials, Composite wing design

AEP02

An autonomous spaceflight navigation enabled with onboard Space Situational Awareness (SSA)

Babu R[1] and Surendar G[1]

[1]Department of Aeronautical Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

The space debris is becoming overpopulated, and present Space Situational Awareness (SSA) systems are limited by coverage, timeliness, and resolution, which purely depend upon ground systems. The onboard operational satellite systems should perform in situ detection and mitigation. Possible cutting-edge sensors are high-resolution optical images, LiDAR, event-based neuromorphic cameras, infrared detectors, miniaturised phased array radars, and or terahertz-based systems with powerful computing resources such as low-power GPUs and AI accelerators, associated with advanced algorithm techniques in generating SSA catalogues in real-time. This onboard-generated catalogue augments global SSA data and operates independently. More advanced and sophisticated algorithms then compute collision probabilities in real time, employing probabilistic conjunction assessment methods. If the probability exceeds predefined thresholds, the system autonomously evaluates the manoeuvre option, accounting for all other safety constraints. Post threat detection and confirmation, the satellites themselves execute collision avoidance manoeuvres independently. In such circumstances, the ground intervention will just function as a mere high-level override. These onboard capabilities reduce operational burden, and response latency provides a paradigm shift toward self-aware, intelligent spacecraft capable of sustaining safe operations. Ongoing developments in AI-driven uncertainty quantification and sensor miniaturisation will be more viable in the coming decades, heralding an era of truly autonomous spaceflight safety.

Keywords: SPACE DEBRIES, SSA, SENSORS, LOW-POWER GPUs

AES01

Enhancing the solar still performance with Tamarind seed powder and carbonized Tamarind seed powder for fresh water production: Energy and exergy analysis

Chandru J[1] and Boopathy G[1]

[1]Department of Aeronautical Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Rapid depletion of freshwater resources and increasing salinity intrusion have intensified the need for intelligent and sustainable desalination technologies. This study presents a smart desalination approach using tamarind seed-derived carbon nanomaterials integrated with experimental investigation and machine learning analysis. Tamarind seeds, an abundant agricultural waste, were converted into carbonized tamarind seed powder through controlled pyrolysis to enhance surface area, porosity, and adsorption capability. Selected nanomaterials were incorporated to develop carbon-based nanocomposites with improved surface functionality and ion interaction characteristics. The synthesized materials were comprehensively characterized using X-ray diffraction, scanning and transmission electron microscopy, Fourier transform infrared spectroscopy, Brunauer-Emmett-Teller surface area analysis, thermogravimetric analysis, and zeta potential measurements. Desalination performance was experimentally evaluated using synthetic saline water and real seawater under varying operating conditions, including pH, salinity, adsorbent dosage, and contact time. The carbonized tamarind seed-based nanomaterials exhibited significantly enhanced salt rejection efficiency, higher water flux, and improved fouling resistance compared to non-carbonized counterparts. To enable smart process prediction and optimization, machine learning models such as random forest, support vector machine, artificial neural networks, and XGBoost were developed using experimentally generated datasets. The machine learning models successfully captured complex non-linear relationships between material properties and desalination performance, demonstrating high prediction accuracy. ML-based optimization identified optimal operating conditions, reducing experimental trials and operational cost. The results highlight the strong potential of integrating biomass-derived carbon nanomaterials with machine learning to develop efficient, low-cost, and sustainable smart desalination systems for future water treatment applications.

Keywords: Tamarind seed-derived carbon nanomaterials, Smart desalination, Machine learning, Biomass-based nanocomposites, Water purification.

CEP01

Experimental Investigation on high strength self compacting concrete with water reducer and self curing cement.

Vinoth[1] and Vinod kumar[1]

[1]Department of Civil Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Traditional concrete requires continuous external curing to achieve its strength and durability. However, in modern construction practices especially in areas with limited water availability or restricted access proper curing becomes challenging. Additionally, high-strength self-compacting concrete (HSSCC) demands a precise mix design to balance workability and mechanical performance. There is a growing need for concrete that can cure internally and maintain its properties without extensive external intervention.

Keywords: Self curing cement with water reducer

CEP02

A Sustainable Approach to Soil Conservation need to protect Environment: Effects of Beneficial Microbes on the Sensory Attributes of Radish root vegetable

Prashantkumar Sidramayya Swami[1] and Geeta Selvarani A[1]

[1]Department of Civil Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Various sources of fertilizer are considered as important factors influencing radish root vegetable. However, different effects of fertilizer sources on radish root vegetable growth performance and consumer preferences are not known. Work carried on field at A G Patil Institutes Campus, Vijapur Road, Solapur, Maharashtra., Lat 17.613036Â° Long 75.892356Â°. Survey was carried at A G Patil Institutes, to determine the consumer preferences on radish root vegetable grown on the GoKrupa Amrutum (implanted bacterial culture field 1) VF1, Natural field (nothing implanted in field 2) VF2 and chemical fertilizers field (implanted 19% N, 19% P, 19% K field 3) VF3. The study carried through google form for sensory evaluations from 24 participants. Using numerical scale from â˜’4 (Dislike extremely) to +4 (Like extremely), analyzed five key attributes: Color, Shelf Life, Texture, Appearance, and Taste. Next to all datasets, a consistent trend emerged where “VF1" variants significantly outperformed then "VF2" and "VF3" counterparts, suggesting high market potential for top-performing varieties. Statistical Package for the Social Sciences is used to transform these raw consumer ratings. To validate these results, a One-Way ANOVA (Analysis of Variance) conducted in SPSS. The p-value is critical for confirming if differences observed between three fields are statistically proven.

Keywords: Bacterial culture field, Natural field and chemical fertilizers field

CET01

Self- Compacting Geopolymer Concrete Using Cassava Peel Ash

Ragasree A[1], Chithambar Ganesh A[1]

[1]Department of Civil Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

This research aims to explore the possibility of using Cassava Peel Ash (CPA) as a sustainable precursor in Self-Compacting Geopolymer Concrete (SCGC). With the increasing importance on eco- friendly construction, the utilization of agricultural waste in cementitious materials was gaining im-portance. Cassava Peel, a readily available by-product, provides a cost- effective and eco- friendly alternative, although its use in geopolymer concrete was still very limited. In this investigation, CPA was utilized as a partial re-placement for Ground Granulated Blast Furnace Slag (GGBS) at a level ranging from 0% to 25% with an increment of 5%. The fresh properties of SCGC, such as passing ability, filling ability and segregation resistance, were evaluated based on EFNARC guidelines, whereas the mechanical properties such as compressive, tensile and flexural strength was determined at 7and 28 days as per IS standard. Sodium hydroxide and sodium silicate was used as an alkaline activator, while glenium sky 8784 was used as a superplasticizer. Result showed that 15% CPA replacement improved mechanical strength, with compressive strength improved by 9.84% and significant improvements in tensile and flexural strength, although workability slightly reduced but remained acceptable. Above 15%, there was reduction in efficiency and workability. The result confirms the potential of CPA in sustainable construction, although more comprehensive mix proportion analyses and practical applications are required. This study provides important information on sustainable construction using Cassava Peel Ash.

Keywords: Self-compacting geopolymer concrete, Cassava peel ash, Workability, Sustainability, Hardened properties.

CET02

Development of One-Part Alkali-Activated Concrete: Performance and Life Cycle Assessment

Yamini V[1] and Chithambar Ganesh A[1*]

[1]Department of Civil Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

This study investigates the influence of varying activator to binder (A/B) ratios on the performance of one-part alkali activated concrete (OPAAC) under ambient curing conditions. Ground granulated blast furnace slag (GGBS) was used as the sole precursor and sodium metasilicate as the solid activator. The objective was to determine the optimal A/B ratio by evaluating fresh, hardened, durability and microstructural properties, combined with a cradle - to-gate life cycle assessment (A1-A3) using the environmental footprint (EF) method. Mixes with A/B ratios ranging from 0.20 to 0.35 were assessed for workability, compressive strength, split tensile strength, flexural strength, water absorption and sorptivity. Workability increased with higher A/B ratios, whereas mechanical properties improved upto an optimum ratio of 0.30, achieving 46.45 MPa compressive strength, 4.22 MPa split tensile strength, 6.08 MPa, flexural strength, 3.8% water absorption and the lowest sorptivity of 0.72 mm at 64 minutes. Beyond this ratio, performance declined due to increased porosity and weakened gel structure. SEM-EDX analysis confirmed dense matrix formation at A/B 0.30. LCA results indicated reduced environmental impacts compared to conventional concrete, with A/B 0.20 showing the best sustainability performance. overall, the findings emphasize balancing mechanical performance with environmental optimization for sustainable construction applications.

Keywords: One-part Alkali activated concrete, Sodium Metasilicate, Activator to Binder Ratio

CET03

Self-Curing Concrete for Water Conservation and Resource-Efficient Construction

Bojja Lakshmi Niranjan Reddy[1] and Vinod Kumar M[1*]

[1]Department of Civil Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

The construction industry faces critical challenges related to excessive water consumption, depletion of natural resources, and increasing environmental pollution. In response, this research presents an innovative self-curing concrete system aimed at achieving water conservation and resource-efficient construction. Polyethylene glycol (PEG-400) was used as an internal curing agent to ensure continuous hydration without the need for conventional external curing. Additionally, copper slag and sugarcane bagasse ash were incorporated as partial replacements for natural fine aggregate and cement, respectively, to promote sustainable material utilization. An extensive experimental investigation was carried out to evaluate the mechanical and durability performance of the developed self-curing concrete. The results indicated that an optimum dosage of 1% PEG-400 significantly improved workability and strength characteristics. The incorporation of 40% copper slag and 10â€“15% sugarcane bagasse ash enhanced compressive, tensile, and flexural strengths while reducing water absorption, sorptivity, and chloride penetration. Microstructural analysis confirmed the formation of a dense and homogeneous matrix due to enhanced hydration and pozzolanic activity. Overall, the study demonstrates that self-curing concrete incorporating waste-derived materials is a viable, eco-friendly solution for water-scarce and sustainable infrastructure applications.

Keywords: Self curing concrete, Copper slag, Sugarcane bagasse ash

CES01

Sustainable Utilization of Waste Materials in the Development of Cost-Effective Precast Concrete Components for Remote and Economically Weaker Communities

Sarma Velavalapalli V V S[1] and Vinod Kumar M[1]

[1]Department of Civil Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

The increasing cost of conventional construction materials poses a major challenge for economically weaker communities, particularly in rural and remote regions. This study investigates the sustainable utilization of locally available agricultural and industrial waste materials in the development of low-cost precast concrete building components. Waste materials such as coconut shells, steel slag, ceramic waste, brick debris, and snail shells were partially used as replacements for fine and coarse aggregates in concrete panels. Mechanical properties were evaluated through compressive, tensile, and flexural strength tests. The experimental results revealed significant improvements in strength at optimum replacement levels. Coconut shells (10%) enhanced strength by 20%, steel slag (30%) improved compressive strength by 25%, ceramic waste (10%) increased strength by 10%, and snail shells (5%) contributed up to 15% improvement compared to the control mix. A cost analysis indicated savings of approximately â‚¹2.94 lakhs per acre for perimeter wall construction using the developed precast panels. The study demonstrates that waste-integrated precast components are economical, sustainable, and structurally efficient, offering a practical solution for affordable housing and infrastructure development in underprivileged communities.

Keywords: Sustainable Precast Concrete, Waste Material Utilization, Cost-Effective Construction, Mechanical Strength Enhancement, Affordable Housing Infrastructure

MCP01

Printability study of 18Ni300 Maraging Steel using Extrusion based 3D printing Technique

Venkatesh M[1] and Praveen AS[1]

[1]Department of Mechanical Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Direct Ink Writing (DIW) represents an extrusion-based additive manufacturing technique capable of fabricating complex three-dimensional architectures through the controlled, layer-wise deposition of viscoplastic inks. Owing to its versatility in processing highly loaded material systems, DIW offers significant potential for the fabrication of metal-based structures with tailored geometries. In the present study, the feasibility of processing 18Ni300 maraging steel a low-alloy steel distinguished by its high strength, superior fracture toughness, and excellent resistance to crack initiation and propagation via DIW was systematically investigated. A printable feedstock was formulated using Pluronic F127 as a thermoreversible binder combined with water as the solvent medium. The influence of metal powder loading, binder concentration, and nozzle geometry on rheological behavior and printability was evaluated to establish stable extrusion conditions. Process optimization involved the identification of suitable printing parameters and the assessment of structural integrity under varying infill ratios to ensure geometrical stability during deposition. The dimensional fidelity of fabricated specimens was quantitatively characterized using digital microscopy, and the associated dimensional deviations were analyzed to assess process accuracy. The findings provide insights into parameter structure relationships governing the DIW processing of maraging steel and contribute to the advancement of extrusion-based metal additive manufacturing.

Keywords: Direct Ink Writing (DIW), Maraging Steel (18Ni300), Extrusion-Based Metal Additive Manufacturing, Rheological Characterization

MCP02

Design and Development of Leak Detection for Hydrogen Powered Internal Combustion Engine(H2-ICE)

Anil Babu Seelam[1*] and Babu M[1]

[1]Department of Mechanical Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

The escalating impacts of climate change on both human societies and natural ecosystems have amplified the urgency for alternative, sustainable energy sources that generate lower emissions. Hydrogen is emerging as a key component of the transition to renewable energy, owing to its potential for "green" production and the wide range of possible applications across various industries. Despite its promise, hydrogen presents significant challenges due to its low molecular weight, high diffusivity, and flammability, necessitating advanced sealing solutions to ensure safe and efficient containment and transport. Currently, there is a lack of standardised and widely available sealing and detection technologies specifically designed for hydrogen applications. This gap in technology presents a significant barrier to the widespread adoption of hydrogen as a viable and sustainable energy source. This Research explores the current challenges in leak detection for hydrogen systems and the need for innovation in this field to support the global hydrogen economy.

Keywords: Leak Detection for Hydrogen

MBAP01

Educational Quality and Labor Market Skill Mismatch: Empirical Evidence on Unemployment Dynamics in the Somali regional State, Ethiopia

Abdiaziz Sheik Mohamed[1] and G manoj[1*]

[1]Department of Management, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

This study examines how government higher-education policy orientation, public university program supply decisions, and curriculum labor market relevance influence graduate unemployment in Somali Regional State, with particular attention to the mediating role of higher education labor market skill mismatch and the moderating effect of labor market absorptive capacity. A quantitative, explanatory research design was employed using cross-sectional survey data collected from 405 public university graduates in Somali Regional State, Ethiopia. Data were gathered through a structured questionnaire and analyzed using SPSS for descriptive and reliability analysis and Smart PLS for Partial Least Squares Structural Equation Modeling (PLS-SEM). Mediation effects were tested using a bootstrapping procedure. The findings reveal that government higher-education policy orientation and public university program supply decisions significantly contribute to curriculum labor market misalignment. Curriculum relevance exhibits a strong negative relationship with skill mismatch. Higher education labor market skill mismatch was found to significantly mediate the relationship between education system factors and graduate unemployment. The study concludes that graduate unemployment in Somali state is primarily driven by structural misalignment between higher education outputs and labor market demand rather than graduate characteristics alone. The study contributes graduate unemployment remains a persistent challenge in many developing economies, including Ethiopia, despite rapid expansion in higher education.

Keywords: quality of education, public university, teacher professional development, teacher effectiveness, graduate unemployment

MBAP02

User Switching Behaviour in Digital Technology Ecosystems: A Systematic Review Based on the Push-Pull-Mooring (PPM) Framework

Ravichandran B S[1] and K Ravishankar[1*]

[1]Department of Management, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

User switching behaviour in the digital technology ecosystems, through the framework of push-pull mooring (PPM), is given in this systematic review. Through various studies in different ecosystems like social media domains, cloud domains, online market domains, mobile application domains etc., The review focuses on where and how the PPM has been applied and the role of the user in designing the switching intention. The Most studies have used only structural equation modeling and limited use of experimental or mixer-method approaches. The three factors are pushing factor, pull factor, and mooring factor. The push factor includes failure of service and dissatisfaction and the pull factor includes perceived usefulness, and the mooring factors include switching cost. These are the three factors that consistently decide the switching intention in any ecosystem but the effect varies for each user. The critical factors that weaken the push-pull and mooring forces include experience, technical expertise, and risk. The users who don't care about risks exhibit stronger resistance to switching, though the push conditions are unfavorable, and when you consider experienced users, they are more responsive to pull factors and less focused on mooring barriers. This review also addresses the gap, which includes underexplored emerging ecosystems insufficient integration of different users into PPM models, over dependence on intention-based outcomes and limited attention to actual switching intention. Over all the study gives the best understanding of PPM-based switching behavior and outlines the clear direction for future research purposes.

Keywords: Digital technology ecosystems; Push-Pull-Mooring (PPM); Platform switching; PRISMA.

MBAP03

Immersive Technologies in Employee Onboarding and Training: A PRISMA Guided Systematic Literature Review

Pugalanthi C[1] and M Jayakumar[1]*

[1]Department of Management, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Background: Empirical evidence on immersive technologies like VR, AR, MR, 360Â° video, and the metaverse for employee onboarding and training is inconsistent across outcomes, theories and sectors, highlighting limited insight into when immersive approaches surpass conventional training. Objectives: This systematic review examines effectiveness patterns, technology types, task-population fit, theoretical frameworks and methodological quality across cognitive, behavioural and motivational outcomes. Methods: Following PRISMA-2020 guidelines, we searched Scopus and Web of Science (2010-2025) with PICOS-based inclusion criteria. Two reviewers independently screened records and assessed quality using CASP (Îº=0.86). Narrative synthesis was conducted due to heterogeneity. Results: Forty-three peer-reviewed studies showed predominantly positive impacts (74%), particularly for complex, safety-critical, and spatial tasks (68% effectiveness; 40-60% error reduction). VR dominated (81.4%). Behavioural outcomes (safety conduct, task performance, error rates) improved significantly. Effectiveness diminished for soft-skills training and simple procedural tasks. Long-term organisational outcomes (transfer, time-to-competence, retention) remain unmeasured (0% of studies). Limitations: All studies used short-term designs (0% â‰¥6-month follow-up), small convenience samples (n<200), and self-reports. Review restricted to two databases and English publications. Conclusions: A task-aligned immersion framework integrating technology acceptance with design features guides matching modality fidelity to task complexity, learner characteristics, and organisational contexts. Registration/Funding: Not registered. No funding received.

Keywords: Immersive technologies; virtual reality; employee onboarding; training effectiveness.

MBAP04

Understanding Social Commerce: A PRISMA-Based Systematic Review of Consumer Behaviour, Social Interactions, and Theoretical Foundations

Kowsalya S[1] and K Ravishankar[1*]

[1]Department of Management, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Social commerce is a combination of social media and electronic commerce; it attracts scholars from various disciplines to research on a particular topic. This study showcases a systematic literature review on social commerce which identifies multiple literatures to ascertain research themes, consumer behavior context, social interaction, to analyze theory and discover existing research gaps. For performing systematic literature peer-reviewed journal articles were retrieved from Scopus and Web of Science database, IEEE databases and screened as per inclusion and exclusion criteria, A total of 52 studies in English language publications were taken and reviewed as per the PRISMA guidelines. The findings illustrates that existing studies are largely concentrated on consumer behavior outcome such as purchase intention, engagement and trust followed by social interaction mechanisms such as ratings, electronic word of mouth, reviews, online communities and influencers. This review highlights how previous studies limited to particular theories such as Technology Acceptance model, Theory of Planned Behavior and Social Influence Theory without any extension and integration of models and also, they restrict the study by quantitative, cross sectional research designs. Even though the research in this particular topic is expanding there are still unexplored gaps in methodology where longitudinal studies, mixed methods, qualitative research methods, mostly the previous studies narrowed their findings by concentrating only on particular geographical regions, platforms for empirical evidence and has a limited focus on post-adoption behavior and AI recommendations. This review summarizes the existing research and highlights gaps in theory and recommends the insights for future studies. It gives suggestions for researchers to utilize the stronger theories and use wider range of research methods to improve the quality of social commerce research.

Keywords: Consumer behaviour, Social commerce, Systematic literature review, Social interaction, Trust

MBA05

Cognitive and Functional Diversity in the Workplace: Employee Passion, Engagement, and Performance

J Shanthi Priya[1] and S Raja[1*]

[1]Department of Management, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

The workplace is facing the increasing need to refine existing increasingly shaped by diversity in how employee think, work, and apply their skills to more sophisticated and effective versions as continues to solve problems. The identifies that positive perception of employees and employer involvement are prerequisites for a successful progress in the workplace. The top management commitment a clearly mission tied to achieve the goals and a supportive culture active employee involvement, an ongoing process for the change, evaluate and modification. As workplace become more complex, managers play a critical role in recognising and effectively coordinating cognitive and functional differences within teams. Rather than viewing diversity as a challenge, this study highlights the importance of positive employee perceptions and active managerial involvement as essential conditions for productive and sustainable workplace progress. Successful Workplace functioning depends largely on leadership commitment, a clearly communicated mission aligned with shared goals, and a supportive work culture that encourages employee participation. Continuous reflection, evaluation, and adjustment of workplace practices are necessary to manage change effectively. The study also acknowledges that differences in, experience, and professional roles can contribute positively to employee performance when properly supported and aligned. To ensure smooth collaboration, effective team coordination, and ongoing performance improvement, emphasis must be placed on strengthening managerial capability not only in managing diverse teams, but in working alongside diversity as a source of innovation and growth. In conclusion, the study presents a strategic framework designed to enhance managerial capability in harnessing cognitive and functional diversity and promoting an inclusive, engaging, and high-performing work environment.

Keywords: Employee passion, Engagement, Performance, Workplace, Practices.

MBA06

Risk Management in the banking sector: The case of Cooperative Bank of Oromia (CBO), Ethiopia

Roba Gudeta[1] and K Ravishankar[1*]

[1]Department of Management, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

Risk management assumes critical importance in financial stability and improved performance in the banking industry, especially when it comes to financial uncertainty and volatility. This study investigates how risk management techniques influence bank performance, with Oromia Cooperative Bank specifically used in this study, encompassing the bank headquarters and five of its selected branches between 2020 and 2025. This study uses a quantitative paradigm in investigating risk management variables and bank performance through fixed effects estimation, relying on panel data. The study employs credit risk, liquidity risk, operational risk, and capital risk, which are captured by using non-performing loans, liquidity ratio, cost-to-income ratio, and capital adequacy ratio, respectively, with return on assets used to proxy bank performance. Findings from the study confirm that there are statistically significant negative correlations between credit risk, liquidity risk, operational risk, and bank performance, implying that an increment in risk affects decreases in bank return or profits. Similarly, the capital adequacy ratio shows a statistically insignificant and positive relationship with bank performance. This study, therefore, underpins critical risk management, especially in mitigating credit, liquidity, and operational risks, to improve profits in banks.

Keywords: Risk Management, Bank performance, Return on Assets

MBA07

From Service Expansion to Sustainable Engagement: Understanding the Evolving Digital Platform Ecosystems.

P Rajshri [1] and G Manoj [1*]

[1]Department of Management, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

The Digital Platform Ecosystems (DPEs) that have been transitioning in urban India have developed from single-service applications into multi-service interactions that include e-commerce, quick commerce, and hyperlocal delivery. These are services that are continuously growing; they are built into the daily urban consumption and access to services. Through this growth, the current literature is restrictive to the short-term spikes of adoption as opposed to the perception of consumers towards this multi-service integration and its impact on long-term commitment in such platforms. To address this gap, the research hypothesis is that the psychological processes crucial to converting service expansion into a long-term interaction include trust and perceived value. Specifically, the integration between services is easy, which enables clients to experience a higher level of value at the ecosystem level and transfer the level of trust established by the current services to new services and remain active in the platform as time progresses. The data were obtained by using a cross-sectional survey on active users of digital platforms in a Tier-1 city metropolitan area to formulate and test a behavioural model that can explain the stability of ecosystem-level engagement. The results explain how the evolution of structural platforms can create steady urban digital coordination and long-term consumer activities in urban environments.

Keywords: Digital Platform Ecosystems; Urban Digital Economy; Multi-Service Integration, Trust Transfer, Perceived Ecosystem Value.

COMP01

Last-Mile Delivery Optimization and Sustainability Trade-offs in Q-Commerce

Sindhuja S [1] and Vijai C [1*]

[1]Department of Commerce, Vel Tech Rangarajan Dr. Sagunthala R& D Institute of Science and Technology, Avadi, Chennai, India-600062.

Abstract

The rapid expansion of Q-commerce has intensified the demand for extremely fast last-mile delivery, while raising concerns about operational cost and environmental sustainability. This study empirically investigates the trade-offs between delivery speed, logistics cost, and carbon emissions in Q-commerce last-mile networks. A multi-objective optimization model is developed to simultaneously minimize delivery time, transportation cost, and COâ‚‚ emissions under realistic urban constraints. Using simulated order data based on a metropolitan distribution environment, the model is solved by a heuristic algorithm to generate Pareto-optimal routing solutions. The findings reveal a clear speed-sustainability trade-off: achieving high-speed delivery significantly increases both operational costs and emissions if not supported by intelligent routing and fleet electrification. The optimization scenarios demonstrate that integrating dynamic routing and partial electric vehicle adoption can reduce emissions and costs without significantly compromising service speed. This study contributes to the last mile logistics literature by providing a unified empirical framework for balancing efficiency and sustainability in Q-commerce. Administratively, these results provide actionable guidance for site operators and urban logistics planners seeking to design greener and more cost-effective high-speed distribution systems. The paper concludes with implications for sustainable urban logistics policy and future research directions.

Keywords: Quick commerce; Last-mile delivery; Multi-objective optimization; Sustainable logistics; Carbon emission.

COMP02

From Scroll to Style: How Social Media Algorithms Shape Fashion Purchases of Gen Z and Millennials in Urban India

Uma Maheswari C [1] and A Jayabal [1]*

[1] Department of Commerce, Vel Tech Rangrajan Dr. Sagunthala R& D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India.

Abstract

The rapid integration of social media into everyday life has fundamentally changed the way consumers discover, evaluate, and purchase fashion products. This study examines how social media algorithms shape fashion purchasing behavior among Gen Z and Millennial's in urban India. Specifically, it examines the role of algorithmic content exposure such as personalized recommendations, influencer visibility, and engagement-based feeds influencing purchase intent and actual purchase behavior. Data were collected from urban social media users from Gen Z and millennial cohorts using a structured questionnaire. Structural equation modeling (SEM) was used to analyze the relationships between key constructs including algorithmic personalization, perceived relevance of content, trust in social media platforms, engagement, and fashion purchasing behavior. The findings reveal that algorithmic personalization significantly improves perceived relevance and engagement, which positively impacts fashion purchasing decisions. Significant generational differences emerge: Gen Z consumers show a strong response to short-form, influencer-led content, while millennials place greater emphasis on information value and site credibility. The study highlights the mediating role of engagement in translating algorithmic exposure into purchase outcomes. This research contributes to the growing literature on digital marketing by providing empirical evidence on the behavioral effects of social media algorithms in the fashion context. The managerial implications suggest that fashion marketers should design algorithm-aware content strategies in line with generational preferences to improve conversion performance in urban Indian markets.

Keywords- Social media algorithms; Fashion purchasing behavior; Gen Z; Millennials; Algorithmic personalization; Influencer marketing; Consumer engagement; Purchase intention; Structural Equation Modeling (SEM); Urban India.

COMP03

Transforming Mobile Commerce Through Ai-Driven Personalized One-Click Payments: Effects on Consumer Trust, Engagement, And Purchase Intention

P M Umadevi [1] and A Jayabal [1*]

[1]Department of Commerce, Vel Tech Rangrajan Dr.Sagunthala R& D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India.

Abstract

This study examines the role of AI-driven personalised one-click mobile payment systems in shaping consumer trust, engagement, and purchase intention in mobile commerce (m-commerce). With the increasing integration of artificial intelligence and digital payment technologies, mobile platforms are adopting personalised and seamless payment solutions to improve user experience and transaction efficiency. Based on the Technology Acceptance Model and the Stimulus-Organism-Response Framework, this research examines how AIdriven payment personalisation affects consumer behaviour. Data were collected from mobile commerce users via a structured questionnaire and analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The results indicate that AI-driven personalisation positively affects consumer trust and engagement, thereby enhancing purchase intention. The measurement model demonstrates satisfactory reliability and validity. The findings emphasise the importance of transparent AI systems and user-friendly payment design in strengthening mobile commerce performance. This study contributes to the growing literature on AI-driven financial technologies and provides practical insights for mobile trading platform developers and policymakers.

Keywords: AI-Driven Personalization, One-Click Mobile Payments, Digital Payment Systems Consumer Trust, Customer Engagement.

LAWP01

Consumer Protection An arena to open investment in a country

Archana R [1] and E Ajitha [1*]

[1]School of Law Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

Consumer protection and a countrys financial markets have an inevitable connection but have received little attention in India. Establishing a safe, welcoming, and open atmosphere where customers may interact with financial goods with confidence is the foundation of responsible finance which in turn stabilises the market. This entails upholding strict guidelines for openness, data security, and fraud prevention while making sure financial services are available to all groups. Indias revolution emphasizes the need to address escalating issues including digital fraud, insufficient consumer protection, and gaps in financial literacy. As India lacks specific statutes to safeguard investors, market stability and regulations play a significant part in establishing additional potential for investment. In addition to attracting investors, filling in the holes in consumer protection will improve market quality and regulations for investor protection through the Consumer Protection Act and SEBI guidelines. Consumer protection in the investment business is about empowering investors to make educated decisions, protecting them against fraud, and providing remedies in the event of injury. The legal safeguards and privileges for investors are the main focus of a nations investment. More investors pick the countrys market as a result of effective consumer protection regulations, ultimately contributing to market stability.

Keywords: Consumer protection, Investments, Market stability

LAWP02

Legitimacy of Ostensible Ownership and Benamidars

Kalpana M[1] and E Ajitha[1*]

[1]School of Law, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-India

Abstract

When we talk about economic growth and property jurisprudence, the concepts that would strike our knowledge are ostensible ownership and benami ownership. Initially, both topics were dealt with under one legal provision, i.e., section 41 of the Transfer of Property Act 1882. The judicial requirement forced the legislative assembly to design a separate law for benamidar ownerships (sham transactions), which resulted in the Benami Transactions (Prohibition) Act, 1988. It is the general understanding of the public that both have one thing in common: that one who is in possession is not the actual owner of the property, but seems to be the owner. When we look at and analyse the concept, we would understand that ostensible ownership is considered a genuine transaction, whereas benami transactions are prohibited with a few exceptions by the Act. It is pertinent to note that sham transactions were not prohibited per se. Many past legislations and judicial decisions have upheld the validity of these transactions. Then arises a question of what was the need to curb the same while permitting ostensible ownership. The general understanding of various jurists, as well as the judiciary, is that the ostensible transaction was needed for promoting business growth, where the actual owner of the property cannot deal with all the business property alienation. Thus, permitting the power to alienate the property by the ostensible owner helped in promoting efficiency of business growth, which ultimately resulted in economic growth. This type of transaction was initially considered genuine. The power was misused by a few people with wicked intent, resulting in significant financial losses through tax evasion and violations of land ceiling laws. The sham transaction was initially considered legal, but it was later declared an illegal act. However, the act was generous in providing the exceptions for genuine benami transactions. This ultimately gained the attention of the legislation to curb its further growth.

Keywords: Ostensible ownership, Benamidars, Acquiescence, bonafide purchaser, fiduciary relationship

LAWP03

Protecting the Individual Investor: A Socio-Legal Analysis of SEBI's Role in Strengthening India's Financial System

Ashok Kumar R.[1] and E Ajitha [1*]

[1]School of Law, Vel Tech Rangarajan Dr. Sagunthala R& D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

Investor protection is essential for maintaining confidence and stability in any financial system. In India, the Securities and Exchange Board of India (SEBI) plays a crucial role in regulating capital markets and safeguarding the interests of common investors. This study adopts a socio-legal approach to analyse SEBI's regulatory framework and its effectiveness in strengthening India's financial system. It examines the evolution of investor protection under the SEBI Act, 1992, and evaluates regulations that promote transparency, accountability, and fair market practices. The study highlights SEBI's initiatives, including disclosure norms, grievance redressal mechanisms, market surveillance, and strict enforcement against fraudulent activities, which have helped reduce market manipulation and enhance investor confidence. However, challenges such as low financial literacy, technological risks, and delays in dispute resolution persist. The paper concludes that while SEBI has significantly improved investor protection, continuous regulatory reforms and increased investor awareness are necessary to address emerging market challenges and ensure long-term financial stability in India.

Keywords: Investor Protection, SEBI, Financial Stability, Market Transparency, Investor Awareness.

LAWP04

Implementing Protection: Legal Gaps and Practical Challenges of Mandatory Reporting under POCSO

Deepika Paira [1] and B Venugopal [1*]

[1]School of Law, Vel Tech Rangarajan Dr. Sagunthala R& D Institute of Science and Technology. Avadi, Chennai, Tamil Nadu, India.

Abstract

The Protection of Children from Sexual offences Act, 2012 (POCSO Act) stipulates that sexual offence against children should be reported compulsory and the parents and the teachers are the most important players that should be involved in protecting children. Although the practice of mandatory reporting has enhanced prompt identification and responsibility, emerging debates in the legal and socio-educational arenas suggest that the application and meaning of the practice by parents and teachers are likely to produce unintended effects. This paper discusses the role of poor legal knowledge, fear of criminal responsibility, and structural ambiguity by the procedures in over-reporting, false-complaints, or exaggerated complaints, and the application of POCSO provisions to non-sexual or minor interpersonal disputes in children. Using judicial observations, empirical studies, which are secondary, and policy considerations, the paper enumerates the way in which this misuse can lead to procedural inconvenience, psychological distress among children, degradation of trust within the school-family associations, and needless criminalization. This study posits that mandatory reporting should not be strictly applied without a proper contextualization and professional judgment because of the threat of overturning the child-friendly goals of the POCSO Act. It also makes clear that the problem lies not in the mandate, but in the lack of organization in legal training, reporting procedures, and institutional support of both parents and teachers. The paper then concludes by suggesting calibrated reporting practices, compulsory legal literacy courses and integration of preliminary child-based assessment systems to ensure fairness between child protection and procedural fairness. To avoid misuse without undermining the main protective purpose of the POCSO Act, raising the awareness and implementing obligatory reporting in equal measures is crucial.

Keywords: POCSO ACT, Sexual offence, mandatory reporting, child-based assessment, false complaint

LAWP05

Legal Protection Vs Ground Reality an Empirical Study on Gig Worker'S Wage Entitlements and Social Security Benefits

Lakshmipriya S [1] and Pamarthi Satyanarayana [1]*

[1]School of Law, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

The rapid expansion of the gig economy has fundamentally altered traditional employment relationships, raising complex questions regarding wage protection and social security entitlements. This thesis, titled â€œLegal Protection versus Ground Reality: An Empirical Study on Gig Workers' Wage Entitlements and Social Security Benefits,â€ critically examines the extent to which Indian labour law reforms address the vulnerabilities of gig and platform workers. While the Code on Wages, 2019 and the Code on Social Security, 2020 aim to extend statutory protections, significant ambiguity persists concerning employment classification, enforcement mechanisms, and practical implementation. Adopting a socio-legal empirical methodology, the study combines doctrinal analysis of statutory provisions and judicial developments with field-based research involving structured surveys and in-depth interviews of gig workers across selected urban centres. The research evaluates wage determination mechanisms, algorithmic management practices, income volatility, awareness of legal rights, and accessibility of social security schemes. The findings reveal a substantial gap between legislative intent and operational reality, highlighting issues of misclassification, weak enforcement, limited grievance redressal, and inadequate social protection coverage. The thesis argues for clearer legal recognition of gig workers, stronger regulatory oversight, and institutional mechanisms to ensure wage justice and comprehensive social security. It concludes by proposing policy reforms aimed at balancing flexibility in the digital economy with the constitutional mandate of social and economic justice.

Keywords: Gig Workers, Wage Protection, Social Security, Platform Economy, Labour Law Reforms

LAWP06

Indian Judiciary Approach on International Treaties for Environmental Protection and Solid Waste Management

[1]School of Law, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

International agreements have a major legal impact on member nations and are essential in guiding global environmental protection activities. Examining the legal effects of international conventions on national laws, policies, and practices, this paper explores an outline of the connection between international treaties and Indian environmental law. It is imperative and crucial to start taking action at all levels, including international, regional, national, local, and community, to address the environmental difficulties that India and other nations confront. It is insufficient to have international treaties, accords, and other instruments on environmental issues and other challenges; rather, the success and efficacy of these policies and agreements largely depend on how well they are completed, implemented, and enforced. Concern and awareness about the need of national and international environmental protection have grown over the past few decades. Through a doctrinal analysis of key constitutional provisions, statutes, and landmark judgments, the paper highlights the judiciary's proactive role in translating international commitments such as those under the Stockholm Declaration (1972), the Basel Convention (1989), and the Rio Declaration (1992) into enforceable national obligations. It also assesses the evolution of principles like the Precautionary Principle, Polluter Pays Principle, and Sustainable Development within Indian jurisprudence. Despite this progressive judicial engagement, the implementation of solid waste management policies remains inconsistent due to weak enforcement, institutional gaps, and fragmented governance. The paper concludes that while the Indian judiciary has been instrumental in bridging global environmental norms with domestic realities, strengthening institutional mechanisms and aligning waste management strategies with international standards remain critical for achieving environmental sustainability.

Keywords: Environmental Law, Solid Waste Management, International Conventions, Indian Judiciary, Sustainable Development, Environmental Governance

LAWP07

The Promotion and Regulation of Online Gaming Act, 2025: A Critical Study with Comparative and Judicial Perspectives

Kothandaraman G [1] and S Udayakumar [1]*

[1] School of Law, Vel Tech Rangarajan Dr. Sagunthala R& D Institute of Science and Technology, Avadi, Chennai, 600062, Tamil Nadu, India.

Abstract

An important piece of legislation designed to organize India's quickly growing digital gaming market is the Promotion and Regulation of Online Gaming Act, 2025. The Act aims to strike a compromise between issues with addiction, financial fraud and money laundering as well as consumer protection, technical innovation and economic progress. The research critically analyses the Act's regulatory framework, enforcement procedures and constitutionality, paying particular attention to Articles 14, 19(1) (g) and 21 of the Indian Constitution. It assesses licensing requirements, compliance requirements, intermediary liabilities and the difference between games of skill and games of Chance. Additionally, the study compares regulatory regimes in other jurisdictions, including the United States' Gambling Act of 2005. To evaluate how Grambling and skill-based gaming are being interpreted, Judicial viewpoints including seminal decisions like state of Bombay Vs. R.M.D Chamarbagwala and K.R Lakshmanan Vs. State of Tamil Nadu are examined. Although the act seeks to provide regulatory clarity, the paper contends that cooperative federalism, proportionate safeguards and consistent judicial interpretation will be necessary for is success.

Keywords: Online Gaming Regulation, Constitutional Law, Comparative Gaming Law, Judicial Review, Digital Economy, Gambling Law, India

LAWP08

Sustainable Development in Practice: Judicial Approaches of the National Green Tribunal

Vageeswari R[1] and S T Naidu[1*]

[1]School of Law, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

The National Green Tribunal (NGT), established under the National Green Tribunal Act, 2010, plays a pivotal role in promoting and enforcing sustainable development in India. As a specialized environmental court, the NGT integrates key principles of sustainable development into its judicial decision-making to ensure a balance between economic growth and environmental protection. This poster highlights the core principles applied by the NGT, including the Precautionary Principle, the Polluter Pays Principle, and the Public Trust Doctrine. These principles, rooted in international environmental law and strengthened during the United Nations Conference on Environment and Development (Rio Summit, 1992), guide the Tribunal in addressing environmental disputes and holding polluters accountable. Through landmark judgments, the NGT has imposed environmental compensation, halted environmentally harmful projects, and directed authorities to restore ecological damage. By operationalizing these principles, the NGT contributes significantly to achieving environmental justice and advancing the Sustainable Development Goals (SDGs), particularly those related to climate action, biodiversity conservation, and pollution control. The Tribunal's proactive approach demonstrates how judicial institutions can serve as effective mechanisms for sustainable governance and environmental protection in developing countries. This study underscores the importance of strong environmental adjudication in ensuring intergenerational equity and safeguarding natural resources for present and future generations.

Keyword: National Green Tribunal, Sustainable Development, Precautionary Principle, Polluter Pays Principle, Public Trust Doctrine

LAWP09

Beyond Monetary Compensation: Reframing Legal Standards for Livelihood Restoration in Displacement and Resettlement

Aswini S[1] and B Someswara Rao[1*]

[1]School of Law, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

Large-scale development projects, including infrastructure expansion, extractive industries, and urban development, frequently necessitate the acquisition of land and the relocation of affected communities. Legal regimes in many jurisdictions have traditionally emphasized monetary compensation as the primary remedy for displacement. However, growing evidence indicates that financial compensation alone is often insufficient to address the long-term socio-economic consequences of displacement, including loss of livelihoods, erosion of social networks, and cultural dislocation. This poster critically examines the distinction between compensation and livelihood restoration within contemporary legal and policy frameworks governing land acquisition, rehabilitation, and resettlement. In the Indian context, statutory provisions relating to fair compensation and rehabilitation represent a significant step toward recognizing the broader impacts of displacement, yet challenges remain in implementation, monitoring, and ensuring sustainable livelihood outcomes. The study also engages with international standards and policy guidance developed by institutions such as the World Bank and the United Nations, which emphasize social impact assessment, participatory planning, and livelihood restoration as integral components of equitable development. These frameworks increasingly advocate a rights-based approach that views affected communities as stakeholders in development rather than passive recipients of compensation. The paper argues that rethinking legal standards to prioritize livelihood restoration, long-term income security, and community resilience is essential for achieving socially just and sustainable development. Strengthening institutional mechanisms, ensuring meaningful participation, and integrating socio-economic rehabilitation into project planning can help bridge the gap between formal legal entitlements and lived realities of displaced populations.

Keyword: Acquisition, legal regimes, displaced populations, rehabilitation, stakeholders.

LAWP10

An analysis of judicial review of administrative discretion in granting environmental clearance in India

Anjana P S [1], Manoj Kumar Ganesh [1*]

[1]School of Law, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology Chennai-600062, Tamil Nadu, India

Abstract:

Environmental clearance in India is a critical regulatory mechanism governed primarily by the Environment Impact Assessment Notification, 2006, issued under the Environment Protection Act, 1986. This process empowers administrative authorities, such as the Ministry of Environment, Forest and Climate Change and State Environment Impact Assessment Authorities to exercise discretion in evaluating project proposals for their potential environmental impacts. Judicial review serves as a constitutional safeguard under Articles 32 and 226 of the Indian Constitution, allowing courts to scrutinize such discretion to prevent arbitrariness, illegality, or irrationality. The topic of judicial review of administrative discretion in environmental clearances has gained prominence due to Indias rapid industrialization and urbanization, which often conflict with ecological preservation. Key principles include the Wednesbury unreasonableness test, ensuring decisions are not ultra vires, and adherence to procedural fairness.Recent Supreme Court decisions, such as the recall of the Vanashakti judgment in November 2025, underscore the dynamic tension between developmental needs and environmental protection, where the Court has shifted from banning expost facto clearances to allowing them under specific conditions to avoid economic waste. This study explores how Indian courts balance administrative autonomy with judicial oversight in this domain.

Keyword: Environmental clearance, Administrative discretion, Judicial Review, Sustainable development.

LAWP11

â€œE-Commerce Taxation in India: Evaluating GST Enforcement and The Emerging Dynamics of Digital Tax Evasionâ€

S Renuka[1], Pamarthi Satyanarayana[1*]

[1]School of Law, Vel Tech Rangarajan Dr.Sagunthala R& D Institute of Science and Technology, Avadi, Chennai-600062.

Abstract:

â€œE-COMMERCE TAXATION IN INDIA: EVALUATING GST ENFORCEMENT AND THE EMERGING DYNAMICS OF DIGITAL TAX EVASIONâ€ ABSTRACT The development of India's e-commerce industry has impacted commercial transactions and expanded the digital market; however, the issue of tax evasion with regard to the Goods and Services Tax is increasing concerns among the market players. Although the legal provisions have been mandated to e-commerce businesses and online sellers across India, the problem of revenue leakages is on the rise. The subject of tax evasion within India's e-commerce market is considered to be a critical issue and is subject to analytical research regarding the legal provisions. Primary objectives of such a study would be to analyse the role of Indian taxation laws and their regulation of e-commerce activities, identify the commonly used techniques of evasion of such taxation, and assess any challenge that may be faced while complying with them. For such a purpose, the present study has adopted a doctrinal method of research and analysis. The study has found that the technological gap between countries, lack of harmonized systems of monitoring, and a changing pattern of electronic trade commerce make enforcement less efficient. It has concluded that the development of advanced digital audit systems, statutory clarifications, and improved coordination of regulations require to effectively curb tax evasion, ensuring a transparent and accountable e-commerce taxation framework in India.

Keywords: E-Commerce, Goods & Service Tax (GST), Tax evasion, Tax system.

LAWP12

Legal Certainty in Cross-Border Insolvency as a Determinant of Foreign Direct Investment

Hari Hara Sudhan K[1], and Someswara Rao [1*]

[1] School of Law, Vel Tech Rangarajan Dr.Sagunthala R& D Institute of Science and Technology, Chennai, Tamil Nadu, India

Abstract

Cross-border insolvency has emerged as a critical legal and economic concern in an era defined by globalization and increased foreign direct investment (FDI). As multinational enterprises expand operations across jurisdictions, financial distress in one country can trigger complex legal consequences in others, affecting creditors, investors, and host economies. Effective cross-border insolvency frameworks promote investor confidence by ensuring predictability, fairness, and efficient resolution of transnational financial failures. Conversely, fragmented legal regimes, conflicting jurisdictional claims, and lack of cooperation among courts can deter FDI inflows by increasing risk exposure for foreign investors. This paper examines the relationship between cross-border insolvency laws and FDI, analysing how harmonized legal standards, recognition of foreign proceedings, and institutional coordination enhance investment security. It further explores the role of international model laws and bilateral agreements in reducing legal uncertainty. The study argues that robust insolvency mechanisms not only protect creditor rights but also foster a stable investment climate essential for sustainable economic growth. Strengthening legal infrastructure, judicial cooperation, and transparency is therefore indispensable for states seeking to attract and retain foreign capital in an interconnected global economy.

Keywords: Cross-border insolvency, Foreign Direct Investment, transnational law, investor protection, insolvency framework, international cooperation, economic stability.

LAWP13

Emerging Challenges to Brand Identity in the Digital Marketplace

K Abirami[1] and Manoj Kumar Ganesh[1*]

[1] School of Law, Vel Tech Rangarajan Dr.Sagunthala R& D Institute of Science and Technology, Chennai, Tamil Nadu, India

Abstract:

The growth of the digital marketplace has changed how brands are promoted and accessed by consumers. Online marketing, e commerce platforms and websites have made it easier for businesses to reach a wider audience, but they have also created new risks for brand identity. Fake websites, misleading domain names, counterfeit products and unauthorised online use of brand names are becoming common problems. These practices confuse consumers and harm the reputation and value of genuine brands. This study explores the emerging challenges faced by brand owners in protecting their brand identity in the digital marketplace, with specific reference to India. It examines whether the existing trademark law is sufficient to deal with online brand misuse and digital infringement. The study reviews important court decisions and highlights practical difficulties in enforcing trademark rights on online platforms. It also briefly refers to international practices followed by organisations such as World Intellectual Property Organization and Internet Corporation for Assigned Names and Numbers, particularly in resolving domain name-related disputes. By identifying gaps in the current legal framework, the study emphasises the need for clearer rules and stronger enforcement mechanisms to protect brand identity in the digital age. The study aims to create awareness and contribute to better legal responses to digital brand protection challenges.

Keywords: Brand Identity, Digital Marketplace, Domain names, Trademark Protection, Fake Websites

LAWP14

An Analysis of Patent Protection in the Fashion Technology industry under Indian Patent Law.

Sudha B [1] and Manoj Kumar Ganesh [1*]

[1]School of Law, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai - 600062.

Abstract

An Analysis of Patent Protection in the Fashion Technology industry under Indian Patent Law. The fashion industry has evolved far beyond aesthetics and artistic expression, emerging as a technologically driven sector where innovation plays a pivotal role in product development, sustainability, and competitive advantage. With the rise of fashion technology encompassing smart wearable devices, 3D knitting machines, eco-friendly textiles, digital fabrication techniques, biodegradable fibers, and AI-assisted design fashion is no longer merely a creative industry but a complex convergence of science, engineering, material innovation, and design. As a result, intellectual property (IP) protection has become essential for safeguarding technological advancements and encouraging continued investment in research and development. In India, patent law operates as a crucial mechanism to protect novel, inventive, and industrially applicable technological solutions. While patent protection has traditionally been associated with pharmaceuticals, engineering, and biotechnology, its relevance in the fashion sector is gaining increasing recognition. Patents now extend to innovations such as temperature-regulating fabrics, self-cleaning garments, antimicrobial materials, advanced sewing machinery, wearable electronics, and environmentally sustainable textile technologies. However, the application of India's patent framework to the fashion technology industry presents several legal, policy-based and practical challenges. Despite the growing technological component of fashion, ambiguity persists regarding the patentability of design-integrated innovations, hybrid products combining functionality and artistic appeal, and sustainable fashion inventions. Further complexity arises from India's strict patentability standards under the Patent Act, 1970 particularly in relation to Section 3 provisions, which restrict protection of mere aesthetic creations, methods of business, and natural biological processes. Unlike jurisdictions such as the United States or the European Union, where patent protection in fashion technology is more actively utilized, India's regulatory environment is still evolving, with limited jurisprudence and policy discourse in this domain.

Keywords: Patent , fashion technology, jurisdiction, protection

LAWP15

Misrepresentation of Geographical Indications in E-Commerce: Implications for Consumer Rights and Legal Enforcement in India

M Sridevi [1] and S T Naidu [1*]

[1]School of Law,Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

The rapid growth of e-commerce platforms has fundamentally reshaped trade practices in India, generating expanded market access for both producers and consumers. However, this digital transformation has also intensified the misrepresentation and misuse of Geographical Indications (GIs), resulting in consumer deception and economic losses to legitimate producers. The unauthorized use of protected geographical names on online platforms erodes consumer confidence, diminishes the distinctiveness of authentic products, and weakens the protective intent of the Geographical Indications of Goods (Registration and Protection) Act, 1999. This study critically explores the emerging challenges posed by GI misrepresentation in online marketplaces and assesses its implications for consumer rights in India. It evaluates the effectiveness of existing legal frameworks, including intellectual property laws, consumer protection statutes, and intermediary liability provisions, in combating digital infringements. Particular attention is given to enforcement barriers such as jurisdictional ambiguities, the anonymity of online sellers, and inadequate digital monitoring mechanisms. The paper contends that stronger regulatory coordination, enhanced accountability of e-commerce intermediaries, and the adoption of technological tools for real-time monitoring are crucial to safeguarding consumer interests and preserving the integrity of Indian GI products. It ultimately advocates for a comprehensive and adaptive enforcement strategy suited to the evolving dynamics of the digital marketplace.

Keywords: Geographical Indication, misrepresentation, consumer protection, digital marketplace, enforcement mechanism

LAWP16

Tnrera Role In Fostering Green Building Compliance and Sustainable Urbanization A Case Study of Chennai Metropolitan Area

N Malarvizhi [1] and S Udayakumar [1*]

[1]School of Law,Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

The main goals of the research include studying the transformational effect of the Tamil Nadu Real Estate Regulatory Authority TNRERA on sustainable urban development and compliance with green building standards in the Chennai Metropolitan Area CMA, examining how legal requirements can contribute to environmental construction and assessing the connection between regional policy and international standards of sustainability, and the effect of mandatory disclosures on green technology implementation. Anticipated statistical frameworks are used to audit the statutory frameworks of TNRERA, assess the tendency of project filing, and consider some examples of certified ecofriendly housing using qualitative methodology. Moreover, it incorporates the experience of city planners and developers in order to identify bottlenecks in the system and policy failures. The findings suggest that, though TNRERA has greatly enhanced the transparency of the industry and fiscal controls, its effects towards sustainability are indirect mainly through environmental permits and Floor Space Index FSI incentives. The research paper indicates that in order that Chennai becomes a climate resilient city in expansion, the TNRERA should no longer be a passive and facilitative oversight institution but a proactive force of sustainable growth.

Keywords: Real Estate Regulatory Authority, Sustainable Urban growth, Ecological Construction, Green Technology, Floor Space Index.

LAWP17

From Law in Books to Law in Action: An Inquiry into The Cybercrime Reporting Dilemma

Alexander C [1] and B Venugopal [1*]

[1]School of Law, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

This study addresses the disparity between the legal frameworks on cybercrime and their practical enforcement, focusing on the difficulties in reporting the cases. It explores systemic, social and technological causes of underreporting taking into account the experiences and views of victims, law enforcement and policymakers. The main obstacles found are the unawareness of the population, lack of confidence in law enforcement, and inefficiency in the procedures. The technological problems, including the changing cyber threats and the insufficiency of reporting systems are also mentioned. This research requests reforms in policies to ensure that the law is in line with enforcement potentials and encourages the employment of support systems and educational programs to empower victims with an ultimate goal of enhancing the efficiency and reliability of the cybercrime reporting models.

Keywords: Cybercrime Reporting, Legal enforcement gap, underreporting of cybercrime, systematic barriers, policy reforms.

MEDP01

Media, mind and culture: Analyzing psychological storytelling in contemporary Tamil cinema

M Agnus Jemeema[1] and M Saravanan[1*]

[1]Department of Media Communication, Vel Tech Rangarajan Dr. Saguthala R&D Institute of Science and Technology, Avadi 600062, Chennai, India

Abstract

Tamil cinema plays a significant role in the Indian film industry and has long served as a powerful medium for storytelling and cultural expression. Recent trends indicate a marked proliferation of psychological dramas, now constituting approximately one-fourth of Tamil cinematic productions. These narratives not only reflect societal values but also shape them, influencing public perception and fostering strong emotional connections with audiences. This study employs qualitative research design to interrogate the ramifications of Tamil film narratives, with a particular focus on those entrenched in psychological motifs. The qualitative methods including content analysis and semiotic analysis are employed to identify recurring themes, character constructions, and narrative structures.

Keywords: Cinema, Culture, Psychology, Semiotics, Audience, Qualitative Research

MEDP02

Exploring Redemption and Acceptance: Cinematic Metaphors in Peranbu and Super Deluxe

Loganayagi Saranya T [1] and M Saravanan [1*]

[1] Department of Media Communication,Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

Tamil cinema's contemporary auteurs, Ram and Thiagarajan Kumararaja, explore marginal lives with strikingly different yet thematically resonant cinematic languages. This paper examines cinematic metaphors and symbolism in Ram's Peranbu & Kumararaja's Super Deluxe movie, focusing on how both films frame the Other the disabled, the transgender, the morally condemned through arcs of redemption and acceptance. In Peranbu, ram structures the narrative into nature-themed chapters like Mist, Snow, Sunshine act as emotional mirrors for a father's journey toward embracing his differently-abled daughter. Motifs like Water, silence, and muted earthy palettes symbolize healing and humanism, contrasting sharply with Super Deluxe's hyper-stylized pulp aesthetic neon colors, religious iconography, alien motifs, and intersecting narratives which confront societal hypocrisy with irony, compassion and reframing marginalized identities through chaotic yet empathetic storytelling. Using auteur theory and visual semiotics, this study applies comparative analysis to examine metaphors of confinement windows, screens, transformation nature, cosmic motifs, and morality like faith Vs chaos shape empathetic narratives across two divergent cinematic styles. It argues that despite their visual contrasts, both films resonate meditations on love, care, and the moral possibilities of human connection. Both filmmakers arrive at a shared humanist vision, offering Tamil cinema new ways to visualize empathy and belonging. By situating these works within global cinematic discourses, the research paper highlights how Tamil auteur contribute to universal conversations on compassion and morality in contemporary world cinema through their innovative use of visual metaphors and symbolic storytelling.

Keywords: Visual Metaphors, Symbolism, Visual Semiotics, Auteur theory, Cinema.

MEDP03

Ethical Concerns in AI-Driven Assessments in the Educational Context: A Theoretical Analysis through Deontological and Utilitarian Perspectives

Deborah Angeline[1] J and M Saravannan[1*]

[1, 2] Department of Media Communication, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, India

Abstract

The integration of Artificial Intelligence (AI) into educational assessment represents a paradigm shift in evaluating student learning. AI-driven tools ranging from automated grading systems to adaptive testing platforms offer unprecedented efficiency, objectivity, and scalability. However, these technological advances also raise pressing ethical dilemmas related to fairness, accountability, transparency, and data privacy. This study addresses these challenges by synthesizing two foundational ethical frameworks: deontological ethics and utilitarian ethics. Drawing on deontological ethics, which emphasize moral duty and responsible implementation, and utilitarian ethics, which assess actions based on their societal benefits and harms, this analysis develops a balanced conceptual framework for the ethical deployment of AI in education. By integrating Kant's duty-based philosophy with the consequentiality perspectives of Mill and Bentham, the study articulates conditions under which AI use in education can be considered ethically legitimate. Findings from a systematic literature review suggest that this legitimacy is contingent upon sustained human oversight, algorithmic transparency, moral accountability, and demonstrable equity in learning outcomes. The proposed framework offers practical guidance for policymakers, educators, and technology developers committed to promoting responsible AI innovation in education.

Keywords: AI-Driven Assessment, Deontological Ethics, Utilitarianism, Data privacy

ENGP01

Narrative Entanglements: Analysing Contemporary Sports Fictions through Knot Theory

SubhaPriya S[1] and Vinoth Kumar M[1*]

[1, 2] Department of English, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, India

Abstract

The integration of Artificial Intelligence (AI) into educational assessment represents a paradigm shift in evaluating student learning. AI-driven tools ranging from automated grading systems to adaptive testing platforms offer unprecedented efficiency, objectivity, and scalability. However, these technological advances also raise pressing ethical dilemmas related to fairness, accountability, transparency, and data privacy. This study addresses these challenges by synthesizing two foundational ethical frameworks: deontological ethics and utilitarian ethics. Drawing on deontological ethics, which emphasize moral duty and responsible implementation, and utilitarian ethics, which assess actions based on their societal benefits and harms, this analysis develops a balanced conceptual framework for the ethical deployment of AI in education. By integrating Kant's duty-based philosophy with the consequentiality perspectives of Mill and Bentham, the study articulates conditions under which AI use in education can be considered ethically legitimate. Findings from a systematic literature review suggest that this legitimacy is contingent upon sustained human oversight, algorithmic transparency, moral accountability, and demonstrable equity in learning outcomes. The proposed framework offers practical guidance for policymakers, educators, and technology developers committed to promoting responsible AI innovation in education.

Keywords: Knot Theory, Narrative Structure, Sports, Identity, Conflict

ENGP02

Mapping Moral and Environmental Concerns in Jonathan Franzen's Fiction: A Digital Humanities Approach

Nathiya M[1], and Priyadarshini M C[1]

[1]Department of English, School of Science and Humanity, Vel Tech Rangarajan Dr. Saguthala R&D Institute of Science and Technology, Avadi 600062, Chennai, India

Abstract

This study applies Digital Humanities methods to analyze moral and environmental concerns in selected novels by Jonathan Franzen, including Freedom, The Corrections, Purity, and Strong Motion. Using computational text analysis, the research maps recurring ethical dilemmas, environmental discourse, and emotional patterns across Franzen's fictional corpus. Tools such as topic modeling, keyword frequency analysis, and sentiment mapping reveal how individual choice, ecological responsibility, and moral seriousness intersect in contemporary American fiction. By combining distant reading with literary interpretation, the study demonstrates how digital approaches enhance the understanding of complex ethical and environmental narratives in Franzen's works.

Keywords: Digital Humanities, Jonathan Franzen, Environmental Ethics, Moral Choice, Computational Text Analysis

ENGP03

Quantum Poetics and Poetic Indeterminacy in the Poetry of T. S. Eliot and Jorie Graham

Deepika I[1], Bairavi B[1]

[1]Department of English, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

This study examines T. S. Eliot's Preludes and Jorie Graham's I Watched a Snake through the conceptual framework of quantum poetics, investigating how both poems structurally resonate with key principles of quantum epistemology, including indeterminacy, superposition, probabilistic potentiality, and observer-dependence. Rather than proposing direct scientific influence, the study argues that quantum theory provides a productive interpretive model for understanding poetic multiplicity and instability beyond traditional hermeneutic approaches. In Preludes, Eliot fragments urban consciousness into overlapping temporal and spatial states in which squalor and transcendence coexist without resolution, suggesting a superposed structure of experience. Meaning remains suspended across competing perspectives, resisting fixed interpretation. Similarly, Graham's I Watched a Snake intensifies perceptual instability through syntactic disruption and shifting attention, presenting the snake as simultaneously material presence and symbolic possibility. In both poems, meaning operates as probabilistic potential rather than determinate statement, requiring reader participation to momentarily stabilize interpretation. By placing these poetic structures alongside quantum epistemology, this study proposes that poetic indeterminacy functions as a systemic structural principle rather than a thematic ambiguity. Quantum poetics thus emerges not as scientific literalism, but as a conceptual vocabulary for analysing how modern and contemporary poetry reconfigures causality, subjectivity, and interpretive certainty within linguistic form.

Keywords: Quantum Poetics, Poetic Indeterminacy, Superposition.

ENGP04

Enclosed Intelligence: The Limousine as a Posthuman Womb in Don DeLillo's Cosmopolis

Karthikeyan R[1] and Dr. Prakash A[1]

[1] Department of English, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

This article is concerned with Cosmopolis by DeLillo in the light of the interlinking forms of posthumanism and biopolitical spatial theory, dwelling on how the limousine is a posthuman womb not a neutral place of passage. Being an enfolded and technologically enclosed zone, the limo changes embodiment, cognition and subjectivity as an agent of mediation among Eric Packer, himself, and the external world. Despite the fact that the current critique of Cosmopolis has focused majorly on financial capitalism, globalization, and digital perception, spatial politics of technological enclosure in the novel have created comparatively low enduring focus. The limo uses this gestational setting, as illustrated in this essay, where the posthuman subject is generated, manipulated, and increasingly unsettled as opposed to a mere representation of wealth or privacy. Within this sealed system, Packer is constantly surveilled via medical exams, scans and algorithm technologies, so he is a hybrid subject where agency is more and more reliant on the mediation of technology. The paper states that the limo enriches existential instability and physical dependence and gives the impression of control, safety, and total awareness. The current study is based on the posthumanist theory, biopolitics and media ecology. The symbolic use of limousine changes throughout the narrative as the womb turns into the coffin, revealing the extremes of posthuman control and the failure of technological safeguards.

Keywords: Posthumanism, Technological enclosure, Biopolitics, Embodiment, Media ecology

ENGP05

From Spectacle to Subject: The Gaze and the Performed Female Body in Sivagamiyin Sabatham

Sneha Georgina A[1], Vinoth Kumar M[1*]

[1] Department of English, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

This study analyzes Kalki Krishnamurthy's Sivagamiyin Sabatham through Judith Butler's theory of Gender Performativity that gender is not innate but produced through repeated social performances shaped by culture and power. Sivagami is initially known as an object of admiration, Her dancing body intersects Discipline', Beauty', and is positioned within a 'Patriarchal gaze'. Her femininity appears naturalized through Grace', Chastity', and 'Artistic refinement'. However, connecting Butler's perception that gender is constituted through repeated social performances rather than innate essence, this study argues that Sivagami's identity is culturally scripted within nationalist and patriarchal structures. Her body becomes a site of political ideologies where 'Honor', 'Freedom', and 'Cultural Pride' are negotiated. Through her vow, abandonment, and moral self-discipline, Sivagami simultaneously inhabits and unsettles the norms that regulate her. The study proposes that her movement from spectacle to subject is not a complete liberation but a tactical compromise within power. Ultimately, the novel reveals how the female body functions as both a 'Surface of Control' and a 'Space of Limited freedom' within gender influenced nationalist discussions.

Keywords: Surface of Control, Nationalist Discussions, Patriarchal Gaze, Female Body, Gender, Dance.

ENGP06

Integrating the Digital Self: A Social-Psychological Model of Identity Coherence in Emerging Adulthood

Blesslin Femi J[1], Revathi P[1]

[1] Department of English, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

Contemporary digital ecologies have transformed identity formation into a continuously visible and socially evaluated process. Through algorithmically mediated feedback, networked comparison, and curated self-presentation, the self is constructed within intensified interpersonal and symbolic interaction contexts central to social psychology. Self-Discrepancy Theory, introduced by E. Tory Higgins (1987), provides a foundational framework for understanding self-structure, yet it does not explicitly incorporate the digitally curated self as an embedded identity domain. This conceptual study extends the theory by integrating the digital self into the core self-system and proposing the Digital Personal Identity Coherence (DPIC) model. The objective is to examine how alignment between online self-presentation and personal values, emotions, behaviors, and identity stability influences psychological well-being. Using theory-driven model construction and interpretive analysis of contemporary coming-of-age novels, Normal People, The Perks of Being a Wallflower, and Eliza and Her Monsters. The study analyses identity negotiation within digitally mediated environments. Findings indicate that psychological strain is associated with weak integration between digital and personal selves rather than discrepancy alone. Reflective awareness, value anchoring, and emotional articulation function as key integration mechanisms. The framework advances social psychological theory and offers implications for digital literacy, youth identity development, and mental health in technologically mediated contexts.

Keywords: Social Psychology, Digital Identity, Self-discrepancy, Influence, and Technology.

ENGP07

Feeling Foreign: Affect, Belonging, and Emotional Negotiation in Firoozeh Dumas's It Ain't So Awful, Falafel and Souvankham Thammavongsa's How to Pronounce Knife

Praveen kumar M [1] and Vinoth Kumar M[1]

[1] Department of English, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

This study comparatively examines Firoozeh Dumas's It Ain't So Awful, Falafel (2016) and Souvankham Thammavongsa's How to Pronounce Knife (2020) through the framework of affect theory. Rather than treating immigrant experience solely through trauma or identity crisis, this study foregrounds the circulation of emotions such as shame, embarrassment, nostalgia, exhaustion, and hope as structuring forces in diasporic subjectivity. Drawing on Sara Ahmed's concept of affective economies (2004), Brian Massumi's theory of affect as bodily intensity (2002), and Lauren Berlant's notion of cruel optimism (2011), the paper argues that both works portray immigrant life as an ongoing emotional negotiation within racialized North American spaces. In Dumas's novel, humor functions as an effective strategy that mitigates xenophobia during the Iranian hostage crisis, enabling the protagonist Zomorod (Cindy) to pursue hybrid belonging. In contrast, Thammavongsa's minimalist stories depict Lao refugees confronting subtle yet persistent forms of linguistic policing and economic precarity, exposing the quiet affective violence beneath multicultural inclusion. Through analysis of name changes, classroom humiliation, pronunciation struggles, and generational tension, this paper demonstrates that diaspora is fundamentally an affective condition. Belonging emerges not merely as legal or cultural inclusion but as emotional recognition. Ultimately, both texts reveal that immigrant identity is shaped through everyday encounters that determine how foreign bodies are felt within national space.

Keywords: Affect theory, Diaspora, Immigrant Identity, Shame and Belonging, Multiculturalism

ENGP08

Intersecting Realities: An Exploration of Queer Subjectivity, Socialization, Intelligibility, and Queer Space in Non-Western Fiction

Shalini M[1] and Ramesh M[1]

[1] Department of English, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

This research investigates how non-Western queer fiction constructs subjectivity, socialization, intelligibility, and queer space, foregrounding literature as a frontier of hope and resistance. By centring texts such as Convenience Store Woman (Japan), Bingo Love (African American), Hani and Ishu's Guide to Fake Dating (South Asian diaspora), and Kari (India), the study highlights the diverse ways queer identities are articulated beyond Western paradigms. These narratives resist homogenizing frameworks by situating queer experience within localized cultural, social, and political contexts. Convenience Store Woman interrogates social intelligibility and the pressures of normative conformity, while Bingo Love reclaims queer love across generations in African American communities. Hani and Ishu's Guide to Fake Dating explores diasporic negotiations of identity, family, and belonging, and Kari visualizes queer space blending personal trauma with collective resistance. Together, these texts demonstrate how queer literature becomes a site of intersectional struggle and empowerment, where subjectivity is not erased but reimagined. Hope emerges as a reparative force sustaining marginalized communities, while resistance manifests as both defiance and creation of alternative modes of living. This project argues that non-Western queer fiction is central to global queer discourse, offering vital insights into how literature functions as a transformative practice, bridging personal realities with collective liberation. By foregrounding these intersecting realities, the research contributes to a more inclusive understanding of queer theory and its global resonances.

Keywords: Queer subjectivity, Non-Western queer literature, Intelligibility, Queer space, Resistance and hope

ENGP09

A Multi-Disciplinary Assessment of AI Tool Integration in English Writing: An Empirical Study of Undergraduate Students

Premkumar J[1] and Ramesh M[1*]

[1] Department of English, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

The integration of Artificial Intelligence (AI) tools into English writing instruction has gained increasing attention in higher education. This preliminary research proposes a multi-disciplinary assessment of AI tool integration in English writing among undergraduate students from Engineering, Arts, and Law. The study aims to examine how AI-based writing assistants may influence students' writing performance and learning practices across diverse academic domains. The study intends to employ structured questionnaires and standardized writing assessments to measure the extent of AI tool usage and its potential impact on writing quality, including grammar, coherence, vocabulary, and organization. It also seeks to explore disciplinary variations in AI adoption and perceived usefulness. The proposed hypotheses are: Hâ‚€â‚: There is no significant difference in English writing performance between students who use AI writing tools and those who do not. Hâ‚â‚: There is a significant positive impact of AI writing tool usage on students' English writing performance. This preliminary investigation is expected to provide a foundation for understanding AI integration patterns and guiding future large-scale empirical studies in English Language Teaching.

Keywords: AI Tool Integration, English Writing, Undergraduate Students, Multidisciplinary Study, Quantitative Research

ENGP10

Narrating Entanglement: Relational Ecology and Environmental Ethics in Contemporary Climate Fiction

Dhanachezhiyan[1] and Manikandan A[1*]

[1] Department of English, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

This paper examines how contemporary climate fiction narrates ecological entanglement through relational ecology and environmental ethics. Drawing on ecocriticism, relational ontology, and Anthropocene discourse, the study explores how literary narratives reconfigure human identity within interconnected ecological systems. Rather than treating nature as passive backdrop, climate fiction presents environment as an active agent that shapes survival, morality, and social structures. Through selected works by Barbara Kingsolver and Paolo Bacigalupi, the paper analyzes contrasting narrative modes of ecological representation. Kingsolver's realist novels Flight Behavior, Prodigal Summer, and The Poisonwood Bible foreground biodiversity, climate disruption, and community resilience, cultivating ethical awareness through intimate environmental engagement. In contrast, Bacigalupi's speculative works The Water Knife, The Windup Girl, and Ship Breaker depict dystopian futures marked by scarcity, corporate biopower, and ecological collapse. The paper argues that contemporary climate fiction constructs entanglement as an ethical condition. By challenging anthropocentric hierarchies, these narratives advance relational models of coexistence grounded in vulnerability, responsibility, and shared ecological fate.

Keywords: Contemporary, Narrative, Ecology

ENGP11

The M(B)aking of a Dream: Intersection of Food and Identity

Gracia A T [1], Vinoth kumar M [1]

[1] Department of English, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

The poster examines the intersection of food and identity in Meet Me at the Cupcake Cafe by Jenny Colgan. It argues that food in the novel functions as more than means of survival; it becomes a powerful medium for self-expression, emotional healing and identity formation. It analyses how culinary space functions as a site of empowerment rather than domestic confinement. Focusing on the protagonist Issy Randall, the study traces her journey from personal insecurity to self-confidence through her passion for baking. The creation of â€˜The Cupcake Cafe' symbolizes her process of self-discovery and professional independence. Baking enables Issy to overcome setbacks, rebuild her emotional strength and redefine herself. Ultimately, the poster establishes that in Colgan's novel, baking becomes an instrument of self-making, a process through which dreams are realized and identity is constructed.

Keywords: Food and Identity, Self-Discovery, Women's Empowerment, Food Studies

ENGP12

The Architecture of Liminality: A Phenomenological Study of Nature and Spirituality in Studio Ghibli's Ecological Landscapes

Shiny Rosilda S[1] , Yasu Bharathi [2]*

[1] Department of English, School of Science and Humanity, Vel Tech Rangrajan Dr. Sagunthala R& D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India.

Abstract

This research examines the intersection of environmental ethics and Shinto-inspired animism in the cinematic works of Hayao Miyazaki, specifically Princess Mononoke (1997) and NausicaÃ¤ of the Valley of the Wind (1984). Moving beyond a literal reading of environmental destruction, this study adopts a phenomenological framework to analyse how Studio Ghibli constructs "liminal spaces" territories where the industrial human world and the sacred natural world overlap. By examining the aesthetic principle of Ma (the intentional use of emptiness or silence), the paper argues that Miyazaki's landscapes function as more than backdrops; they are active, sentient entities that challenge the Western dichotomy between "civilization" and "wilderness." The research further explores the concept of Kamikakushi (spiriting away) as a metaphor for the modern disconnection from the Earth. Ultimately, this paper posits that Ghibli's animation fosters a "radical empathy," encouraging a post-humanist perspective where the preservation of nature is seen not as a political necessity, but as a spiritual reunification of the self with the biosphere.

Keywords- Phenomenology Shinto Animism Environmental Ethics Liminality Ma (Silence) Post-humanism

ENGP13

From Mother-Tongue Cognition to English Articulation: A Neuro-AI Framework for Spoken Language Mastery

Jenifer R [1] and Yamini G [2]

[1]Department of English, School of Science and Humanity, Vel Tech Rangrajan Dr.Sagunthala R& D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India.

Abstract

Mastery of spoken English remains a persistent challenge for non-native speakers worldwide despite advances in pedagogy and language technologies. Frequent errors in pronunciation, fluency, and syntactic construction indicate that traditional classroom instruction and conventional AI based language systems fail to address the underlying cognitive and neural mechanisms of language acquisition. Human thought is deeply rooted in the linguistic, cultural, and emotional frameworks of the native or regional language, and these ingrained cognitive structures often do not transfer seamlessly into English. This mismatch contributes to lexical retrieval difficulties, syntactic interference, and accent-related distortions, particularly in multilingual environments where internal reasoning occurs in a different language from external communication. It is to propose a Neuro-AI framework that integrates cognitive theory, neuro linguistic processes, and adaptive artificial intelligence to model the interaction between learners' mother-tongue cognitive architectures and English language production. This multidisciplinary approach offers a transformative pathway for advancing spoken language pedagogy through the convergence of neuroscience and artificial intelligence.

Keywords: Neuro-AI, Lexical Retrieval, Cognitive Theory, Multilingual Environments, Language Acquisition.

ENGS01

Alchemy of Hope in Paulo Coelhos Brida A study through Charles Snyders Hope theory

Rajkumari C[1], Rajeswari A [2]

[1]Department of English, School of Science and Humanity Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

The paper entitled Alchemy of Hope in Paulo Coelho's Brida: A Study through Charles Snyder's Hope Theory is a research article that focuses on the application of hope and its elements to the protagonist, Brida. Generally, hope is considered an emotion, but the American psychologist Charles Snyder defines it as a working theory that provides a structured model for practicing hope in daily life to achieve happiness. According to Snyder, hope theory consists of three elements: agency thinking, pathway thinking, and goals. When an individual applies hope theory, they instill optimism in themselves and around them. The protagonist, Brida, a 21-year-old young woman, is in search of her identity and purpose in life. Through hope and steadfast nature, she attains her goal finally. The novel Brida projects the themes of love, spirituality, and occult tradition. The objective of the paper is to highlight the importance of hope in one's life in attaining desired goals.

Keywords: Hope Theory, Love, spirituality, Occult tradition, Resilience, Goal

ENGS02

Tracing SDG 1 10 and 16 in Imayams Uppuvandikkaran

Ebinezer D[1], Rajeswari A [2]

[1]Department of English, School of Science and Humanity Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

The research article aims to trace down the United Nations Sustainable Development Goals 1, 10, and 16 in Imayam's Uppuvandikkaran. SDG 1 - No Poverty, SDG 10 Reduced Inequalities and SDG 16 Peace, Justice and Strong Institutions which are the primary focus of the article. Imayam's novel Uppuvandikkaran deals with poor salt vendor's family who suffer during the COVID-19 pandemic lockdown period. The class inequality, labour burden, dalit livelihood, corrupt government and lethargic administration, dehumanization, violation of rules, and loss of hope in life are portrayed in the novel. The article focuses how Shanmugam and his family is shattered because of COVID-19 pandemic. Thus, COVID-19 pandemic paved way to poverty, further leading way to restless unjust society. Shanmugam's caste, class and occupation lead to inequality.

Keywords: SDG, COVID-19, Poverty, Inequality, Peace, Justice, Imayam,

ENGS03

Literature for a Green Future Rethinking Sustainability and Environmental Justice in the Select Novels of Amitav Ghosh

Gayathiri S.[1] and Bairavi B[1]

[1]Department of English, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R& D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

Literature plays a crucial role in shaping ecological awareness by linking historical responsibility with contemporary sustainability concerns. This research examines how environmental justice and sustainable futures are articulated in the selected novels of Amitav Ghosh through postcolonial and environmental humanities perspectives. Ghosh's fiction reveals how present-day ecological crises are inseparable from colonial histories of resource extraction, territorial reorganization, and environmental exploitation. By foregrounding landscapes shaped by rivers, forests, coastlines, and oceans, the narratives expose the uneven ecological burdens borne by marginalized communities. The novels portray land and water as active agents within historical and ethical processes, emphasizing the entanglement of human and non-human lives. Issues such as displacement, sea-level rise, ecological precarity, and climate instability are presented not as isolated events but as consequences of long-standing structural inequalities. Through memory, migration, and storytelling, Ghosh reimagines sustainability as a relational practice grounded in justice, responsibility, and interdependence rather than technological intervention alone. The paper discusses on the literary narratives offer critical insights into sustainability by challenging anthropocentric and Eurocentric models of environmental thought. By integrating environmental justice with postcolonial critique, Ghosh's novels contribute to rethinking ecological futures that prioritize ethical coexistence, resilience, and global responsibility in an era of accelerating climate crisis.

Keywords: Sustainability, anthropocentric, postcolonial, environmental justice

ENGS04

Climate Change Literature and Environmental Consciousness

Henry Leonash[1] and Prakash A[1*]

[1]Department of English, School of Science and Humanities, Vel Tech

Rangarajan Dr. Sagunthala R& D Institute of Science and Technology. Avadi, Chennai, Tamil Nadu, India.

Abstract

Climate Change Literature and Environmental Consciousness explores the role of literary narratives in shaping public awareness and ethical engagement with the climate crisis. While scientific research undoubtedly provides crucial data about environmental change, literature offers a complimentary space in which climate change is experienced through stories, emotions, and everyday human relationships with the natural world. This paper explores how the literature of climate change engenders environmental consciousness by rendering abstract ecological processes as meaningful human experiences. The paper draws on ecocritical perspectives to foreground that contemporary literature underlines interdependence between humans and nonhuman life, challenges anthropocentric worldviews, and questions extractive attitudes toward nature. It is through narrative, symbolism, and character-driven storytelling that such works encourage readers toward the recognition of Earth not as a passive resource, but as a living system which demands care, responsibility, and ethical attention. By engaging readers both affectively and intellectually, climate change literature engenders empathy, reflection, and a profound sense of environmental responsibility. The study advocates that through shaping the values and attitudes toward ecological change with imaginative responses, literary narratives play a vital role in the process of environmental education. In so doing, literature forms modes of environmental consciousness supportive of more sustainable ways of thinking and living during an era of global climate uncertainty.

Keywords: Climate Change Literature, Ecocriticism, Environmental Storytelling, Human-Nature Relationships

ENGS05

IRD Emotional Engagement Measurement system for Serialized Media

Brundavanam P[1] and Priyadarshini M C[1]*

[1]Department of English, School of Science and Humanities, Vel Tech

Rangarajan Dr. Sagunthala R& D Institute of Science and Technology. Avadi, Chennai, Tamil Nadu, India.

Abstract

The Interest-Reaction-Depth of Emotion (IRD) Theory explains how audiences emotionally engage with television series and how this engagement gradually develops into deep emotional bonding and relaxation. In the contemporary media environment, television and OTT series play a significant role in providing emotional comfort, stress relief, and cultural connection. This theory proposes that audience engagement occurs in three stages: Interest, where viewers are initially attracted by narrative, visuals, and cultural elements; Reaction, where repeated viewing, binge-watching, and active engagement occur; and Depth of Emotion, where viewers experience long-term emotional attachment, comfort, and influence. The theory is applied to Indian, Korean, and American television series, each representing distinct cultural values, lifestyles, and emotional expressions. To operationalize the theory, a Human Emotion Interaction System is introduced, which collects user responses through structured questions and quantifies emotional engagement using an IRD scoring method. Each component Interest, Reaction, and Depth of Emotion is measured on a scale of ten and converted into percentage values to enable comparative analysis. The system helps audiences understand their emotional preferences and relaxation patterns while watching series. Overall, the IRD Theory demonstrates that television series function not only as entertainment but also as emotional and cultural agents that shape audience feelings, preferences, and social understanding.

Keywords: Emotional Engagement, Audience Analytics, Human Computer Interaction, Emotion Artificial Intelligence, Television and OTT Studies

ENGS06

A Theoretical Study of Anthropomorphism: The Human Psychology Behind Treating Non-Human Beings as Human in the Select Films

Divyadharshini A[1,] Manikandan A [1*]

[1]Department of English, School of Science and Humanity Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

The interaction between people and Artificial Intelligence (AI) in the contemporary digital world is now a significant field of interest. With the improvement of technology, people usually begin to treat machines, robots, and digital systems as humans. This study is concerned with the psychological motivation of this behaviour and the presentation of emotional relationships between humans and the non-human world in the films. The research is grounded on the anthropomorphism theory, which explains the origin of human emotions, thoughts and personality traits to non-human objects. This study has applied a qualitative research approach. They are analysed in terms of thematic interpretation of selected movies, including Enthiran, Her, Robot and Frank, After Yang, Koogle Kuttappa, and Companion. In this work, the authors concentrate on the scenes in which human characters emotionally rely on AI and start treating them as their actual companions. The study will also seek to determine psychological implications of such relations, such as emotional attachment, dependency, identity confusion, and emotional shock upon AI loss. It also examines how the behaviours create social transformations. Lastly, the research proposes that AI should be used responsibly and in equal measure to cushion human emotions and values.

Keywords: Anthropomorphism, Artificial Intelligence, Human Psychology, Emotional Attachment, Film Analysis

ENGS07

Modern Cinema and its Multi-Functional Conflict An intricate study on Distress in Feminine and Fatherhood

Mathivadhani [1], Revathi P[2]

[1]Department of English, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai – 600062,

Tamil Nadu, India.

Abstract

This study examines modern cinema through the theoretical lens of Distress Theory, positioning distress not merely as emotional suffering but as a complex psychological, relational, and socio-cultural condition that shapes identity and action. Titled Modern Cinema and its Multi-Functional Conflict: An Intricate Study on Distress in Feminine and Fatherhood, the research explores how contemporary films construct distress as both an experiential reality and a narrative strategy. Distress Theory enables the analysis of how internal psychological turmoil interacts with external structures such as patriarchy, moral expectation, caregiving responsibility, and social judgment. Within feminine narratives, distress emerges through silenced trauma, resistance, and identity negotiation in restrictive cultural spaces. In fatherhood narratives, distress manifests through emotional repression, protective instinct, ethical conflict, and the burden of responsibility. Modern cinematic techniques non-linear storytelling, visual symbolism, performance intensity, and unresolved endings reflect the fragmented and persistent nature of distress described in Distress Theory. By employing a qualitative interpretative methodology grounded in gender studies and conflict theory, this research argues that modern cinema transforms distress into a multi-functional conflict that operates simultaneously at personal, relational, and societal levels. The study ultimately demonstrates that distress is central to understanding contemporary cinematic narratives of both feminine identity and fatherhood.

Keywords: Distress Theory, Modern Cinema, Feminine Identity, Fatherhood Conflict, Multi-Functional Narrative.

ENGS08

The Crip Play Space: Finding Wholeness in the Virtual Magic Circle

Keerthana R[1], Prakash A[1]*

[1]Department of English, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai – 600062,

Tamil Nadu, India.

Abstract

This study examines the representation of disability and virtuality in contemporary literature, arguing that imagined game worlds shift disability narratives away from medicalized cure models toward concepts of wholeness, well-being, and belonging. Rather than framing disability as a deficit requiring physical restoration, the study reconceptualizes it as Crip Play Space, an imaginative and affective zone where play enables empowerment, community, and self-acceptance. Drawing on Robert McRuer's Crip Theory and Johan Huizinga's concept of the Magic Circle, the research defines this space as one in which disabled characters engage creatively with identity through ludic participation. Through a comparative analysis of Ready Player One, The Speed of Dark, The Peripheral, Tomorrow, Tomorrow and Tomorrow, and Piranesi, the study explores how game-like narrative structures and virtual environments function as modes of healing. These texts challenge dominant literary frameworks that depict disability as something to be overcome, instead emphasizing emotional resilience, social connection, and self-understanding. The study addresses a critical gap in disability scholarship by rejecting normalization as the goal of healing. Its broader social significance lies in dismantling the assumption that disabled lives require a physical â€œcureâ€ to be meaningful. By foregrounding the Neurodiversity Paradigm, the concept of Crip Play Space also offers an innovative framework for inclusive digital design, demonstrating that true healing emerges from spaces where diverse bodies and minds can flourish.

Keywords: Disability Studies, Crip Theory, Game Studies, Neurodiversity, Digital Culture, Holistic Healing.

PHYP01

Investigation of Optical Characteristics and Visible-Light Photocatalytic Efficiency of Solution-Combustion-Derived Spinel ZnMnâ,,Oâ,„ Microcrystals

Gnana Sekar G[1] and Prabakaran A[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

In this work, ZnMnâ,,Oâ,„ spinel oxide was synthesized through a simple and low-cost one pot solution combustion route. Structure confirmation and crystallinity were verified via X-ray diffraction analysis, while FTIR spectroscopy revealed the characteristic metal oxygen vibrations. The morphological features were revealed through Field emission scanning electron microscopy. The FESEM revealed a distinctive surface architecture composed of well-defined truncated cuboidal microcrystals coupled with wafer-like thin plates. The elemental composition of the prepared oxide was further elucidated by energy dispersive X-ray analysis. UVâ€“visible diffuse reflectance spectroscopy was employed to probe the optical response and extract key optical constants. The material exhibits a direct optical band gap of 3.0 eV, indicating its semiconducting behavior. The photocatalytic capability of ZnMnâ,,Oâ,„ was explored toward environmental remediation using Malachite Green and Crystal Violet dyes under visible-light exposure. Using 20 mg of catalyst for 10 ppm dye solutions, ~84% degradation efficiency was achieved within 90 minutes, with kinetic analysis supporting a high reaction rate. The combined influence of dual morphology, semiconductor characteristics, and surface activity contributes to the enhanced dye degradation, positioning the prepared ZnMnâ,,Oâ,„ as a promising photocatalyst for wastewater treatment applications.

Keyword: Spinel oxide, Photocatalysis, Semiconductor, Combustion, Cuboid morphology.

PHYP02

Surfactant-Engineered MgO Nanoparticles prepared via Co-Precipitation for Enhanced supercapacitor Application

Georgelin Jeba Mahiba G [1] and Prabakaran A[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

Magnesium oxide (MgO) nanoparticles were synthesized via a facile co-precipitation method using five different surfactants like cetyltrimethylammonium bromide (CTAB), oleic acid, polyethylene glycol (PEG), polyvinyl alcohol (PVA), and polyvinylpyrrolidone (PVP) to investigate the effect of surfactant-assisted growth on their structural, morphological, and electrochemical properties for supercapacitor applications. X-ray diffraction analysis confirmed the formation of phase-pure MgO with a crystalline cubic structure, in good agreement with the standard JCPDS card No. 00-089-7746. The characteristic diffraction peaks indexed to the Miller planes (111), (200), (220), (211), (311), and (222) were observed at diffraction angles of approximately 37Â°, 42Â°, 58Â°, 62Â°, 74Â°, and 78Â°, respectively, with marginal variations in peak intensity arising from surfactant-dependent crystal growth. Morphological analysis revealed distinct nanostructures depending on the surfactant used: as CTAB-assisted MgO exhibited spherical bud-like features, oleic acid produced well-defined spherical nanoparticles, PEG resulted in flake-like structures, PVA led to clustered morphologies, and PVP promoted sheet-like architectures. These variations significantly influenced electrolyte accessibility and charge transport characteristics.

Keywords: Magnesium oxide nanoparticles, co-precipitation, surfactant, supercapacitor applications.

PHYP03

Structural, Vibrational, Surface, Morphological and Electrochemical Investigations of MoS2-Cr2O3 Nanocomposite Electrode for High-Performance Supercapacitors

Nandhini S [1], Yuvaraj S [1*]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract:

MoS2-Cr2O3 nanocomposite (NC) was successfully synthesized and characterized for its structural, vibrational, surface, morphological, and electrochemical properties. XRD and SAED confirmed the rhombohedral phases of MoSâ,, and Crâ,,Oâ,*ƒ* with an average crystallite size of ~40 nm. FT-IR verified characteristic CrO and CrO vibrations, indicating high purity. SEM and HR-TEM revealed uniform cubic morphologies with reduced particle size, enhancing surface area and electrochemical activity. XPS confirmed the elemental states of Mo, S, Cr, and O. Electrochemical studies in 3 M KOH showed excellent redox behavior, with specific capacitances of 875.9 F/g (CV) and 1698.8 F/g (GCD). EIS indicated low resistance (0.69 Î©), and the NC retained 90.3% capacitance after 3000 cycles. The MoSâ,,Crâ,,Oâ,*ƒ*//AC asymmetric supercapacitor exhibited combined EDLC pseudocapacitive behavior and delivered 41.3 Wh/kg, demonstrating its promise for wearable electronics, portable devices, hybrid vehicles, and next-generation energy-storage systems.

Keywords: MoS2-Cr2O3 nanocomposite; structural; cubic Morphology; Asymmetric supercapacitor (ASC); Electrochemical Performance;

PHYP04

Binary Metal-Organic Frameworks as Multifunctional Materials for Energy Storage and Photocatalytic Applications

Sukanna Maji[1], Pradeep Reddy Vanga[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract:

A monometallic and a bimetallic nickel- and cobalt-based metal-organic framework were synthesized via the solvothermal method. The structural and physicochemical properties were systematically investigated using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), and field emission scanning electron microscopy (FESEM). The XRD confirmed the formation of a crystalline framework structure, while FTIR validated the successful coordination between Ni, Co ions and the organic linker. FESEM revealed nanosheets like morphology. The electrochemical evaluation using a three-electrode configuration demonstrated that all prepared samples exhibited pseudocapacitive behaviour, with the binary NiCo-MOF showing high reversible Ni2+/Ni3+ and Co2+/Co3+ redox reactions, indicating efficient charge storage capability. The photocatalytic activity of Ni-MOF, Co-MOF, and NiCo-MOF was assessed via the degradation of Rhodamine B dye, achieving excellent performance within 120 minutes. The combined electrochemical and photocatalytic results indicate that NiCo-MOF is a promising multifunctional material for energy storage and environmental remediation applications.

Keywords: Metal Organic Framework, solvothermal synthesis, pseudocapacitive behavior, energy storage, photocatalysis.

PHYP05

Exploring the Supercapacitive Behavior of Hydrothermally Derived Ni(VO3)2.2H2O

Sivapriya G [1], Pradeep Reddy Vanga [1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

Nickel vanadate hydrate (Ni(VO3)2.2H2O) was successfully synthesized via a facile hydrothermal method and investigated as a potential electrode material for supercapacitor applications. The crystalline structure of the prepared sample was confirmed by X-ray diffraction (XRD), which verified the formation of phase-pure nickel vanadate hydrate. Field emission scanning electron microscopy (FESEM) analysis revealed a well-defined morphology. The electrochemical performance was evaluated using cyclic voltammetry (CV), galvanostatic charge discharge (GCD), and electrochemical impedance spectroscopy (EIS) in a three-electrode configuration. The material revealed improved charge storage performance under the tested conditions. These findings demonstrate that hydrothermally synthesized Ni(VO3)2.2H2O is a promising candidate for high-performance supercapacitor applications.

Keywords: Nickel vanadate hydrate, Hydrothermal synthesis, Three electrode system, XRD, FESEM.

PHYP06

Recent Advances in Vanadium-Based One-Dimensional and Two-Dimensional Nanomaterials for Gas-Sensing Applications: A Comprehensive Review

Karthika N[1], Babu Balraj[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract:

Gas sensing technologies play a crucial role in environmental monitoring, industrial safety, and healthcare diagnostics by enabling the rapid detection of hazardous and trace gases. Among emerging materials, vanadium-based one-dimensional (1D) and two-dimensional (2D) nanomaterials have attracted significant attention due to their tunable electronic properties, high surface-to-volume ratios, and rich surface chemistry. This review presents a comprehensive overview of recent advances in vanadium oxides, sulfides, and carbides, focusing on their synthesis methods, structural characteristics, and gas-sensing performance. Particular emphasis is placed on the roles of 1D nanowires, Nano rods, and nanotubes, as well as 2D Nano sheets and two-dimensional transition metal carbides and nitrides with surface terminations (MXenes), in improving sensitivity, selectivity, and response dynamics. We discuss key sensing mechanisms, including chemiresistive, electrochemical, optical, and field-effect transistor platforms, and highlight how defect engineering, doping, and hetero structure formation enhance performance. Comparative analyses show that vanadium-based nanostructures achieve ultralow detection limits for gases such as NOâ‚‚, NHâ‚ƒ, and VOCs, often operating at room temperature and outperforming many conventional metal oxide sensors. Finally, current challenges such as long-term stability, humidity interference, and scalability are discussed, along with future directions for integrating vanadium nanomaterials into smart, wearable, and Internet-of-Things-enabled gas-sensing systems.

Keywords: Chemiresistive sensors, Gas sensing, Hetero structures, IoT-enabled sensors, MXenes, One- and two-dimensional nanostructures, Room-temperature sensing, Vanadium-based nanomaterials.

PHYP07

Unveiling High-Performance Mg-ion Electrolytes Based on Plasticized Guar Gum for Energy Storage Applications

Thiruveni U [1], Monisha S [1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

The demand for sustainable, high-performance energy storage systems accelerates the development of eco-friendly solid biopolymer electrolytes (SBEs). In this study, a guar gum (GG) based SBE incorporating glycerol as a plasticizer and magnesium chloride (MgClâ‚‚) as a dopant salt is prepared for Mg-ion batteries via solution casting method. X-ray diffraction reveals enhanced amorphous character, while Fourier transform infrared spectroscopy confirms polymer salt complexation. Morphological analysis shows a uniform and homogeneous surface. The optimized electrolyte (1.5 g GG: 0.3 ml glycerol: 0.6 g MgClâ‚‚) achieves a maximum ionic conductivity of 1.02 Ã— 10â»Â³ S cmâ»Â¹ at 303 K, significantly higher than pure GG. Thermal analysis indicates good stability with a reduced glass transition temperature of 42.72 Â°C. Linear sweep voltammetry demonstrates electrochemical stability up to 2.05 V, and a high ionic transference number (tion = 0.96) confirms dominant ionic transport. Cyclic voltammetry exhibits clear redox behaviour, and the interfacial adhesion energy reaches 131.39 J mâ»Â². The assembled Mg-ion battery delivers an open-circuit potential of 2.43 V, a power density of 76.05 mW gâ»Â¹, and stable galvanostatic chargeâ€“discharge performance at 50 ÂµA, demonstrating its potential for sustainable magnesium-based energy storage application.

Keywords: Guar gum, solid biopolymer electrolyte, plasticizer, ionic conductivity, Open Circuit Potential, Mg-ion battery, GCD

PHYP08

â€œFabrication of La-Doped NiCoâ‚‚Oâ‚„ Electrodes for Synergistic Electrochemical Performance in Supercapacitor Applicationâ€

Gayathri A[1] and Sridhar S [1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

The structurally uniform and mechanically stable electrode preparation using a high-conductivity pseudocapacitive oxide materials are important for the development of advanced energy storage systems. Doping with rare-earth elements introducing lattice defects, enhancing ion transport, and stabilizing the nanostructure. La-doped transition metal oxides are promising platform for next generation best working electrodes. In this study fabrication of Lanthanum-doped Nickel Cobaltite (La- NiCo2O4) synthesized via cost effective co-precipitation method with different lanthanum concentrations (1%, 3%, 5%, and 7%), aiming to enhance electrical conductivity, specific capacitance, and cyclic stability. NiCoâ‚‚Oâ‚„ has a significant attention as a well-suited electrode material for supercapacitors due to its high electrical conductivity, rich redox activity, and low cost. The modulated of LaÂ³âº ions in NiCo2O4 tunes the electronic structure and improves charge transport characteristics which evaluated in a three-electrode configuration by analyzing electrochemical performances. The incorporation of La into NiCoâ‚‚Oâ‚„ materials were synthesized by a co-precipitation method to obtain crystalline spinel NiCoâ‚‚Oâ‚„. The resulting composites were finally used for further structural and electrochemical investigations. The doping concentration was studied through XRD and FTIR analyses, while SEM revealed a porous morphology favorable for ionic transport. The X ray diffraction pattern shows the main diffraction signals can be assigned to the cubic spinel NiCoâ‚‚Oâ‚„ phase with Fd-3m symmetry, demonstrating that single phase NiCoâ‚‚Oâ‚„ has been obtained without detectable secondary phases. Electrochemical studies ensured pseudocapacitive characteristics dominated by reversible redox reactions of NiÂ²âº/NiÂ³âº and CoÂ²âº/CoÂ³âº couples. The ion-diffusion-controlled process was validated by the power-law relationship, higher specific capacitance, and reduced charge-transfer resistance for La-doped NiCoâ‚‚Oâ‚„ compared to pristine NiCoâ‚‚Oâ‚„, indicating improved electrochemical performance for supercapacitor applications.

Keywords: Pseudocapacitive materials - Electrode - Supercapacitor

PHYP09

Recent Advances in Mxene-Based Gas Sensors: Materials Development, Sensing Mechanisms, and Application Prospects

Revathi M[1] and Babu Balraj[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

MXenes are a type of two-dimensional nanomaterial that contains carbides, nitrides, and carbonitrides generated from transition metals. MXenes have gained a lot of interest for their distinctive chemical composition and layered structure, which makes them ideal for sensing applications. These materials are often produced through selective etching of A-layers from MAX phase precursors, resulting in highly conductive and surface-active nanosheets. This study discusses current advances in MXene-based gas sensors, focusing on production processes, surface functionalization strategies, and sensing mechanisms for detecting dangerous and environmental gases. The importance of material design and composite production in improving sensor sensitivity, selectivity, response, and recovery properties is clearly demonstrated. Despite significant progress, issues like as long-term stability, reproducibility and selective detection in complicated gas environments persist. The review also addresses recent developments aimed at overcoming these restrictions. Future research directions are also indicated, with an emphasis on the development of novel MXene compositions, better production techniques and successful integration into practical sensing devices. This research seeks to provide useful recommendations for the design of next-generation high-performance MXene-based gas sensors.

Keywords: MXenes; Gas sensors; Surface functionalization; Charge transfer; Adsorptionâ€“desorption mechanism; Two-dimensional materials

PHYP10

Solid State Biomaterial Electrolyte from Plectranthus amboinicus for proton conducting Batteries

Kowsalya S[1] and Prameela P [2]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R& D Institute of Science and Technology, Avadi, Chennai – 600062, Tamil Nadu, India.

Abstract

Bio-material solid electrolytes have gained increasing attention as sustainable alternatives to conventional polymer electrolytes for energy storage applications. In this work, a proton-conducting bio-material electrolyte was prepared using Plectranthus amboinicus leaf powder doped with ammonium thiocyanate (NHâ„„SCN) via a solution-casting method. X-ray diffraction (XRD) analysis revealed that salt incorporation significantly enhanced the amorphous nature of the electrolyte, and the degree of crystallinity was quantitatively determined using the XRD area method. Thermogravimetric analysis (TGA) demonstrated good thermal stability of the prepared membranes. AC impedance spectroscopy indicated a maximum ionic conductivity of 1.06 Ã— 10â»Â³ S cmâ»Â¹ at room temperature for the optimized composition containing 0.8 wt% NHâ„„SCN. Transference number measurements confirmed dominant ionic transport with an ionic transference number of 0.98. Linear sweep voltammetry revealed a wide electrochemical stability window of 2.9 V. Moreover, a primary proton battery fabricated using the optimized electrolyte delivered an open-circuit voltage of 1.54 V, demonstrating the potential of the developed bio-material electrolyte for proton battery applications.

Keywords: Plectranthus Amboinicus, Ammonium Thiocyanate, Proton Conducting battery, Electrochemical Stability, Solution casting Technique

PHYP11

Tuning Sodium - ion Transport In a KC-SN Solid Biopolymer Electrolyte to Energy Storage Application

Vishwa D[1], Monisha S[1]

[1]Department of Physics, School of Science and Humanity,Vel Tech Rangarajan Dr. Saguthala R&D Institute of Science and Technology, Avadi 600062, Chennai, India

Abstract

A sodium-ion-conducting KC-SN-based electrolyte was prepared using Kappa carrageenan (KC) and sodium nitrate (NaNOâ‚ƒ) via solution casting technique. X-ray diffraction (XRD) assessment revealed the mixed semi crystallineâ€“amorphous characteristics, where 1 g KC-0.6 wt.% NaNOâ‚ƒ system exhibited enhanced amorphous nature. Fourier-transform infrared spectroscopy (FTIR) confirmed strong molecular interactions between KC and NaNOâ‚ƒ while scanning electron microscopy (SEM) with EDS mapping demonstrated a uniform surface morphology with evenly distributed Na+ ion within the biopolymer matrix. Upon NaNo3 incorporation enhanced absorption intensity was observed with sharp peaks in 200â€“300 nm range. Electrochemical impedance spectroscopy (EIS) showed an increase in ionic conductivity from 1.85Ã—10-5 to 7.1Ã—10-4 S/cm at ambient temperature by varying NaNOâ‚ƒ concentration from 0.1-0.6 wt.%. Differential scanning calorimetry (DSC) evaluation indicates a decrease in the glass transition temperature (68.03 Â°C), verifying the increase in segmental mobility and flexibility of the biopolymer backbone whereas thermal decomposition behaviour of the electrolyte was analysed using thermogravimetric analysis (TGA). Linear sweep voltammetry (LSV) was used to extract the electrochemical stability of the optimum KC-SN-based electrolyte, which revealed a stability window of 3.13 V. Cyclic voltammetry (CV) analysis exhibited stable and reversible redox behaviour over 15 successive cycles, with well-defined anodic and cathodic peaks at +0.49 V and 0.44 V respectively, which indicates good reversible transfer of Naâº ions. Further the optimized KC-SN-based electrolyte attained an open circuit potential of 3.13 V, an energy density of 1.38 Wh/g and power density of 15.6 mW/g, when employed in a solid-state primary battery, confirming its practical applicability in sodium-based energy storage devices.

Keywords: Bio-derived polymer electrolyte, Kappa Carrageenan, NaNOâ‚ƒ, Ionic conductivity, Electrochemical durability, Sodium-ion energy storage device

PHYP12

Exploration of Metal chalcogenide for their versatility in multiple domians

Soumya Ranjan Nayak S P[1], Sharmila S[1]

[1]Department of Physics, School of Science and Humanity Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

As development in computational technology is about to peak the world is looking beyond algorithms to enhance and optimise the functionality of modern's devices, in that aspect material science has been at the forefront. With the objective of developing advance functional materials scientists have been exploring the metal chalcogenide-based materials. Metal chalcogenide-based material systems possess tuneable band gap, ferroelectricity, disorder controlled insulating as well as superconductive behaviour which make them versatile for multi domain application. Among all the chalcogenide Tin mono sulphide SnS stands out as it forms a 2-dimensional van der wall heterostructure with other materials that promotes better electron hole dynamic influencing strong interfacial coupling without lattice mismatch. Material with these heterostructure are very sensitive photodetectors and exhibits photosensitivity 7.31 e 10-3. A/W which makes it a promising material for photodetector and solar cell application. Furthermore, Application of such material exhibit hydrogen evolution at 5mmol/g which presents itself as very good photocatalyst. Its abundant availability and nontoxic nature make these material one of the most suitable material for environmental remediation.

Keywords: Chalcogenides, 2D, Tin Doped

PHYP13

Structural, Morphological, and Optical Insights into ZnO/g-C3N4 Nanocomposites via XRD, SEM, and UV-DRS Analysis for Visible-Light Photocatalysis

Kannammai S P[1], Sridhar S[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, India

Abstract

Graphitic carbon nitride (g-Câ,*f*Nâ,,,) was explored as a highly viable visible light photocatalyst in the absence of any metal content. It offered good prospects for stabilization when combined with ZnO-based semiconductor materials. The present researchers attempted to assess the feasibility of ZnO/g-Câ,*f*Nâ,,, nanocomposites. In this study, the respective nanocomposites were synthesized using the co-precipitation method followed by thermal polycondensation method. XRD analysis confirmed the simultaneous presence of graphitic C-N and ZnO wurtzite structures along with interfacial interactions. The average crystallite size was observed to be present in the ZnO/g-Câ,*f*Nâ,,, nanocomposites. From the SEM analysis, the presence of ZnO nanoparticles across the g-Câ,*f*Nâ,,, nanosheets was obvious. Indeed, a porous nanocomposite structure was observed to be present. Inconsistent band gaps were assessed using the UV-DRS analysis.

Keywords: g-Câ,*f*Nâ,,,/ZnO heterojunction, Visible-light photocatalysis, Congo red degradation, co-precipitation.

PHYP14

Sustainable Bio-Derived SiC/GO Hybrid Nanocomposite Ink Coating for Enhanced Thermal Conductivity and Cooling Efficiency in Aluminium Heat-Sink Systems

Ashique H[1], Saranya A[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology Chennai-600062, Tamil Nadu, India

Abstract

This work describes the preparation of a SiC/GO nanocomposite with biowaste- derived eggshell CaO and its encapsulation into a printable ink based on graphene-oxide for thermal enhancement. The nanocomposite was incorporated into an ink matrix of graphene oxide embedded, and coated into a uniform covering onto aluminium cubes. The controlled heating inputs of 40 W, 60 W and 80 W with temperature profiles monitored using a K-type thermocouple with a Medi Logger GL260 system were conducted. It was observed that the coated samples had a mechanism of reduced heat absorption and faster cooling times significantly than those of the uncoated substrate, which is the characteristic of better thermal conductivity and faster heat-dissipating behaviour provided by the SiC/GO nanocomposite ink. A thorough physicochemical characterisation, which comprised XRD, SEM-EDS, TEM, BET, FTIR, XPS and TGA/DTA, confirmed that there was successful composite formation, homogeneous dispersion, increased surface activity, and increased thermal stability. The results indicate that the designed nanocomposite ink is an efficient and sustainable solution in terms of passive cooling enhancement of compact electronic circuits that has a promising future over traditional methods of heat-sink modification.

Keywords: Thermal Management. Heat Sink, Nanocomposites, Biowaste, Thermal enhancement ink

PHYP15

Mg incorporation on V2O5 for chromic application

Mohan Kumar S[1] and Jayaprakash K[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology. Chennai-600062, Tamil Nadu, India

Abstract

Mg-doped Vanadium pentoxide(V2O5) nanoparticles were successfully synthesized through a hydrothermal method with a short period of reaction followed by successive annealing. In this work, the prepared samples were used to explore how the incorporated Mg on the layered structure will influence the structural and thermal behavior. Mg2+ plays a role in surface modification, altering the optical properties and varying the band gap. Structural and Phase confirmation are examined by XRD, which confirms the slight shift due to the lattice distortion obtained by Mg ion. Morphological changes are investigated by FESEM analysis. While the elemental composition verified by EDX shows successful incorporation of Mg. UV-VIS studies are examined for band gap variation. By steadily varying temperature, a discernible yellow-to-orange change is obtained for pure and Mg-doped V2O5, and by lowering the temperature, the color changes back to yellow. It reveals the reversible thermochromism, making Mg-doped V2O5 a promising material for temperature-responsive, smart-switching, and functional device applications.

Keywords: Vanadium, Hydrothermal method, lattice distortion, Band gap tuning, Reversible thermochromism

PHYP16

Synergistically Enhanced CNT-Decorated Fe2O3 /La2O3 Nanocomposites Synthesized Via Raphanus Sativus Extract for High Performance Supercapacitor

Sunil Kumar A[1] and Saranya A[1]

Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology Chennai, India.

Abstract

Fe2O3/La2O3/CNT nanocomposite as ternary nanocomposite was synthesised from Raphanus Sativus extract was effectively achieved using green method. The nanocomposites were also stepped into vibrational sample magnetometer (VSM) and fended the coercively (Hc) is 250 Oe. At 250 Oe, demonstrating semi-hard magnetic behaviour makes it may suitable for magnetic storage. Fe2O3/ La2O3/CNT nanocomposite (FeLC NC) exhibit's an excellent specific capacitance of 438 F/g. 75 % of its capacity was maintained even after undergoing 4,000 cycles. This asymmetric capacitor device, combining iron oxide and carbon-based electrodes with Fe2O3/La2O3/CNT, has a power density of 2381Whg-1 and a energy density of 67.4Wh Kg-1. Fe2O3/La2O3 /CNT composite reveal significant capacitance, and outstanding cyclic performance owing to the synergistic effect of Fe2O3/ La2O3/CNT nanocomposite as well as in asymmetric supercapacitor.

Keywords: Green synthesis, Raphanus Sativus, Supercapacitor, Energy density and Power density.

PHYP17

Engineering Gadolinium MRI Contrast Agents: Chelate Stability, Relaxivity Physics, and Strategies to Minimize Tissue Retention

Elavarasan S[1] and Rigana Begam M[1]

Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology. Chennai-600062, Tamil Nadu, India

Abstract

Gadolinium-based contrast agents (GBCAs) represent a prominent application of paramagnetic materials in magnetic resonance imaging (MRI), viewed primarily through spin physics and magnetic relaxation theory. The GdÂ³âº ion possesses seven unpaired 4f electrons, resulting in a high magnetic moment (S = 7/2) that efficiently enhances proton spinâ lattice (Tâ,) relaxation of surrounding water molecules. By shortening the longitudinal relaxation time, GBCAs increase signal intensity in Tâ,-weighted sequences and improve the contrast-to-noise ratio, enabling precise visualization of tumors, inflammatory regions, and vascular abnormalities. The relaxivity of these agents is governed by key physical parameters, including rotational correlation time, water exchange kinetics, electronic relaxation behavior, coordination number, and external magnetic field strength. To prevent the toxicity associated with free GdÂ³âº ions, gadolinium is administered as a chelated complex, where thermodynamic stability and kinetic inertness determine in vivo safety. However, recent reports of trace gadolinium retention in brain and bone tissues have raised questions regarding metal ligand dissociation, transmetallation processes, and long-term biophysical interactions. These concerns have stimulated research into macrocyclic ligand design, high-relaxivity systems, and nanostructured platforms. Future perspectives emphasize rational molecular engineering and exploration of alternative paramagnetic or superparamagnetic agents, guided by a deeper understanding of spin dynamics and magnetic interactions in complex biological environments.

Keywords: Gadolinium-based contrast agents (GBCAs), Magnetic Resonance Imaging (MRI), Spin lattice relaxation (Tâ, relaxivity), Chelate stability and kinetic inertness, Gadolinium retention.

PHYP18

Structural and Electrochemical Characteristics of Mn3O4 NP, binary Mn3O4-NiO and ternary Mn3O4-NiO/rGO nanocomposite for Supercapacitor Application

Thamarai S [1], Rajesh Kumar U [1]

[1] Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Avadi, Chennai – 600062. India

Abstract

In the present work, MnO2 nanoparticles, MnO2-NiO and MnO2-NiO/rGO nanocomposites were successfully synthesized through as simple co-precipitation method. XRD and Raman studies verifies the structural confirmation. The morphological and elemental confirmation were determined using the FESEM with EDX analysis. XPS verifies the existence of expected elements. The electrochemical behavior was studied using a standard three-electrode setup. The electrochemical performance was analyzed through Cyclic Voltammetry (CV), Galvanostatic charge/discharge (GCD) and electrochemical impedance spectroscopy (EIS). The electrochemical testing revealed a maximum specific capacitance of 235 F g-1, 342 F g-1 and 620 F g-1 for MnO2, MnO2-NiO and MnO2-NiO/rGO respectively. The overall results suggesting that the prepared MnO2-NiO/rGO has a strong potential as an electrode material for high-performance supercapacitor applications.

Keywords: Nanocomposites, Supercapacitors, Three-electrode

PHYP19

Multiwavelength Analysis and Evidence of Neupert-like behaviour of an X5.2 Flare

Sastha G[1], Jayaprakash K[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Chennai, India

Abstract:

An observational and quantitative investigation of energy release in the X5.2-class solar flare that occurred on 11 November 2025 in NOAA Active Region 4274 is presented. This study combines multiwavelength imaging, X-ray diagnostics, and photospheric magnetic field measurements to examine magnetic energy conversion during an extreme eruptive event. Extreme ultraviolet observations from the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory in the 171 Ã… and 193 Ã… channels reveal large-scale coronal loop expansion, interaction, and post-flare arcade formation, indicating substantial magnetic restructuring. Chromospheric emission in AIA 1600 Ã… shows the formation and progressive separation of two primary flare ribbons. Co-alignment of ribbon brightenings with Helioseismic and Magnetic Imager (HMI) line-of-sight magnetograms enables estimation of ribbon separation velocity, reconnection electric field, and magnetic reconnection rate during the impulsive phase. Soft and hard X-ray emissions from GOES and STIX are analyzed to investigate flare energetics. The hard X-ray flux peaks prior to the soft X-ray emission, exhibiting Neupert-like behavior, supporting a scenario in which accelerated non-thermal electrons drive chromospheric heating and plasma evaporation. These results provide quantitative observational constraints on reconnection-driven energy release and particle acceleration in major solar flares.

Keywords: Solar flares, Magnetic reconnection, Hard X-ray emission, Multiwavelength observations, Neupert Effect.

PHYS01

Biomass-Derived Activated Carbon from Peanut Shells Integrated with MgO/SiO_2/GO Nanocomposites for High-Performance Supercapacitor

Priya Dharshini C[1] and Saranya A[1]

[1]Department of Physics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

Next-generation energy storage systems demand advanced electrode materials that offer both high performance and long-term sustainability. Binary (MgO/SiO_2) and ternary (MgO/SiO_2,,/GO) nanocomposites prepared in the current work were used to investigate the suitability of these materials as electrode material for supercapacitors with a view towards embedding biomass-derived carbon (BDC) obtained from peanut shells (Arachis hypogaea L.) were activated using NaOH and Activated carbon (AC) of peanut shells (AC) is produced. Peanut shells are renewable carbon matrix with good porosity for ion dispersion and charge, storage. The ternary MgO/SiO2/GO system exhibits both redox activity and mechanical integrity was investigated, where the incorporated GO offers increased surface area and electrical conductivity. Structural and morphological (XRD, SEM, FTIR and XPS) analyses substantiate the formation of porous nanocomposites. The ternary composite supercapacitor electrode shows an extraordinary specific capacitance of 473 F/g (scan, rate at 10 mV/s) and a current density of 482 F/g at 1A/g 6M KOH electrolyte, which is higher than the binary nanocomposites. In addition, it reveals,94.14% capacity retention and over 95% coulombic efficiency along with an outstanding cyclic stability up to 5000 GCD cycles. Consequently, MgO/SiO_2/GO-AC electrode exhibits potential applications for high-yield electrochemical super capacitors in the near future.

Keywords: Green synthesis method, Activated peanut shell carbon, Specific capacitance.

CHEP01

DFT ANALYSIS OF POLYMER FOR ANTICANCER DRUG DELIVERY: ELECTRONIC STRUCTURES, DRUG ENCAPSULATION AND RELEASE

Shamsudeen Yahaya[1] and Kanni Raj A[1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

The study aims to utilize Density Functional Theory (DFT) using Gaussian-16 software to analyze the electronic properties, stability, and reactivity of a fluorescent amphiphilic homopolymer and the anticancer drug doxil with their polymer-drug conjugate, to translate the mechanisms of polymer-assisted drug delivery and controlled release at molecular scale. All molecular systems underwent geometry optimization using DFT in Gaussian-16. Frontier molecular orbital energies, including highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO), were calculated alongside reactivity electronic calculations such as electronegativity, chemical hardness and electrophilicity. Comparative electronic analyses such as hardness, softness, and chemical potentials were conducted on the polymer, doxil drug, and the polymer-drug conjugate to evaluate conjugation effects on drug-polymer interactions relevant to drug delivery efficiency. The polymer exhibits a wide HOMO-LUMO energy gap, indicating high structural stability. Doxil shows enhanced electronic reactivity due to its conjugated aromatic framework. Upon conjugation, the polymer-doxil system displays a significantly reduced energy gap, lower chemical hardness, and increased electrophilicity, suggesting improved charge transfer, stronger molecular interactions, and favorable conditions for controlled drug encapsulation and release. These results highlight the role of polymer conjugation in modulating drug electronic properties. The research presents a computationally driven framework linking DFT-derived electronic calculations with polymer-assisted drug delivery behavior, offering molecular-level insight into how polymers can enhance the performance of clinically established anticancer drugs. The study demonstrates the utility of Gaussian-16-based DFT analysis as a tool for designing next-generation polymer-drug delivery systems. The results are matched exactly with experimental drug encapsulation and delivery results.

Keywords: Density Functional Theory (DFT), Gaussian-16, Drug Delivery, HOMO-LUMO, Doxil.

CHEP02

Nanoarchitectonics of Indian Jujube Seed-Derived Carbon Dots: Characterization, Light-Induced Processes and Potential Applications

Sanjay T[1] and Kathiravan A[1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Fluorescent carbon dots synthesized from green plant precursors exhibit wide-ranging applications in sensing, bioimaging, and environmental monitoring. In this study, for the first time, the Indian jujube seeds were utilized as a carbon precursor for the synthesis of fluorescent carbon dots by the one-step hydrothermal method without any additives. The morphology and spectral characteristics of carbon dots are studied using microscopic and spectroscopic techniques such as scanning electron microscopy (SEM) and high-resolution transmission electron microscopy (HR-TEM), UV-Vis absorption spectroscopy, fluorescence spectroscopy, Raman spectroscopy, and Fourier transform infrared spectroscopy (FTIR). The morphological analysis revealed the formation of well-dispersed nanoparticles, while the spectral studies demonstrated a typical excitation-dependent emission behaviour attributed to the presence of multiple surface functional groups. In addition, the as-synthesized carbon dots showed excellent sensitivity and selectivity toward Fe3+ ions in an aqueous medium, highlighting their effectiveness as fluorescent probe for Fe3+ ions and their applicability in environmental and biological settings.

Keywords: Indian jujube seeds, Carbon Dots, Fluorescence, Sensors, Fe3+ ions.

CHEP03

Addressing Sensitivity-Range Tradeoffs in Reaction-based Probes via Spacer-Acceptor Synergy Engineering

Bhuvaneesh[1] and Kathiravan A[1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

The longstanding sensitivity-range tradeoff in reaction-based chemosensors has been addressed in this work by spacer-acceptor synergy engineering. Two Donor-Pi-Acceptor systems, featuring rigid and flexible spacers achieve rapid and selective cyanide ion sensing via Michael addition. The flexible probe offers an detection limit of 0.39 nM with a narrow linear range, while the rigid probe demonstrates a detection limit of 4.2 nM and a broad linear range. The underlying mechanism is elucidated using 1D/2D NMR, steady-state and time-resolved fluorescence spectroscopy and computational studies. Furthermore, their practical utility is validated through fluorescence paper strips and LFP imaging.

Keywords: Cyanide, Chemosensor, Conformational locking, Linear range, Limit of detection

CHEP04

Green-Synthesized Non-Biologically Active Zirconium dioxide Nanoparticles for Targeted Drug Delivery Applications

Emil Jebaz D [1] and Edayadulla N [1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Nanoparticles exhibit unique physicochemical and biological characteristics that have driven extensive research into their applications in medicine, catalysis, and environmental remediation. Among various fabrication strategies, green synthesis has gained significant attention as an environmentally benign and sustainable approach, as it eliminates the use of toxic chemicals and energy-intensive conditions. In this study, Peltophorum pterocarpum (P. pterocarpum) flower extract was employed as a natural reducing and stabilizing agent for the synthesis of zirconium (Zr) nanoparticles. The formation and characteristics of the synthesized nanoparticles were confirmed using a range of spectroscopic and microscopic techniques. FTIR analysis indicated the presence of phytochemical functional groups responsible for nanoparticle reduction and stabilization, with a characteristic Zrâ€“O stretching vibration observed at 680 cmâ»Â¹, confirming successful nanoparticle formation. GCâ€“MS analysis revealed 13 bioactive compounds in the flower extract that contributed to nanoparticle stabilization. XRD patterns demonstrated the crystalline nature of the nanoparticles with a tetragonal phase. FESEM images showed predominantly spherical morphologies, while HR-TEM analysis indicated an average particle size of 18.75 nm. The biological activities of the Zr nanoparticles were evaluated through antimicrobial, antioxidant (DPPH and FRAP), and anticancer (MCF-7 cell line) studies. The nanoparticles exhibited negligible antimicrobial, antioxidant, and anticancer activities, indicating minimal intrinsic bioactivity. This biocompatible and stable behavior highlights their potential suitability for targeted drug delivery applications, where low toxicity and controlled reactivity are essential.

Keywords: nanoparticles; green synthesis; Peltophorum pterocarpum flower; biological activity; target drug delivery

CHEP05

1-(Pyridine-2-yl)imidazo[1,5-a]pyridine: A Viable Receptor for Copper Tripeptide

Mahalakshmi Narayanan[1] and Kathiravan A[1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu.

Abstract

Environmentally benign and sustainable sensing strategies for transition metal ions are increasingly important due to the ecological and biological implications of metal contamination. In this study, we report the development of intramolecular charge transfer (ICT) active donor acceptor fluorophores designed for the selective and sensitive detection of copper species, including biologically relevant copper peptide complexes, with an emphasis on environmental compatibility and analytical performance. The molecular architecture integrates amine-based electron donors with an imidazopyridine acceptor core, enabling efficient charge redistribution upon photoexcitation while maintaining chemical robustness and low toxicity. The probes exhibit strong ICT fluorescence that is selectively quenched in the presence of Cu2+ ions and copper-bound peptide species through coordination at the pyridine-rich acceptor site. This interaction produces a pronounced optical response under mild conditions, without the need for harsh reagents or complex sample preparation. High selectivity toward copper is retained even in the presence of competing metal ions and free peptides, enabling trace-level detection of copper at the peptide level using minimal probe concentrations. The sensing mechanism is supported by absorption and emission spectroscopy, demonstrating reversible complexation and well-defined electronic perturbation associated with copper tripeptide binding. Importantly, the probe design prioritizes benign molecular components, low cytotoxicity, and compatibility with aqueous and biologically relevant environments, aligning with principles of sustainable chemical sensing. The combination of sensitivity, selectivity, and environmental compatibility highlights the potential of this platform for ecofriendly monitoring of copper speciation in peptide-rich biological and environmental systems. Overall, this work demonstrates how rational ICT-based molecular design can deliver sustainable, non-invasive, and chemically compatible fluorescent sensors, advancing green approaches to metal ion and copper tripeptide detection.

Keywords: Imidazopyridine, fluorometric sensor, GHK peptide

CHEP06

Investigation of Excitation Wavelength-Dependent Sensing Mechanisms in Carbon Dots

Suguna Premkumar P[1] and Kathiravan A[1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

The unique photophysical channel of Excitation Wavelength-dependent emission of Carbon dots (CDs) has great utilization in analytical and biological applications. Though, such phenomena of analyte interaction are hardly explored in CDs. In this present study, CDs are synthesized by using microwave-assisted method and characterized by SEM, TEM, FT-IR, XPS, UV-visible absorption and fluorescence spectroscopy techniques. The resultant spectroscopic studies expose that the emission from the CDs definitely depends on the excitation wavelength, were the heterogeneous emissive surface states on the surface of CDs confirming its presence. The estimated relative fluorescence quantum yield is 16.4 %. The selectivity studies with CDs, rather than the other metal ion interaction with CDs, Only Hg2+ ion respond quickly with oxygen- and nitrogen- containing surface functional groups of CDs. At the excitation wavelength of 340, 390, 460 nm has a detection limits of CDs exhibit 26 nM, 81 nM, and 14 nM for Hg2+ ions respectively. For exploring, the sensing measurements, most common techniques are used Stern-Volmer analysis and time-resolved fluorescence decay measurements. The obtained results show negligible toxicity and facilitating intracellular bioimaging of Hg2+ quenching and L-cysteine-mediated recovery. The attained results on CDs signify a potential stand for excitation wavelength-dependent metal-ion detection and live-cell imaging applications.

Keywords: Carbon dots, Sensing, Recovery, live cell imaging

CHEP07

Synergistic Integration of rGO and Protonated g-C3N4 with CeNiO3 Perovskite for Enhanced Electrochemical and Supercapacitor Performance

Mathangi A[1], Roniboss A[1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology,

Abstract

Supercapacitors are indispensable for contemporary energy storage regarding their incredible rapid charge and discharge capabilities, high power density, and long cycling life. Perovskite-based electrode materials have attracted increasing attention for supercapacitor applications due to their tunable crystal structures, rich redox activity, and structural stability. CeNiOâ‚ƒ perovskite oxide was successfully synthesised via a facile hydrothermal method and systematically investigated for its structural and electrochemical properties. CeNiO3 is an exemplary electrode material because it encompasses pros such as the electrochemical activity of Ce and the structural stability of Ni. X-ray diffraction analysis confirmed the formation of a well-crystallised orthorhombic perovskite phase, consistent with standard database patterns. Electrochemical performance was evaluated using cyclic voltammetry (CV), galvanostatic chargeâ€“discharge (GCD), and electrochemical impedance spectroscopy (EIS) in 1M KOH electrolyte. The CeNiOâ‚ƒ electrode exhibited a high specific capacitance of 661 F gâ»Â¹ at a current density of 1 A gâ»Â¹, an energy density of 12.7 Wh kgâ»Â¹ and a power density of 249.99 W kgâ»Â¹. These results demonstrate that CeNiOâ‚ƒ is a promising electrode material for high-performance supercapacitor applications. Future studies will focus on fabricating CeNiOâ‚ƒ-based composites with rGO and protonated g-Câ‚ƒNâ‚„ composite materials to enhance electrical conductivity, increase active surface area, and long-term electrochemical stability.

Keywords: Perovskites, rGO, protonated g- C3N4, Hybrid supercapacitors, Energy storage

CHEP08

DFT ANALYSIS OF POLYMER FOR ANTICANCER DRUG DELIVERY: ELECTRONIC STRUCTURES, DRUG ENCAPSULATION AND RELEASE

Shamsudeen Yahaya[1] and Kanni Raj A[1]

[1] Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology

Abstract

The study aims to utilize Density Functional Theory (DFT) using Gaussian-16 software to analyze the electronic properties, stability, and reactivity of a fluorescent amphiphilic homopolymer and the anticancer drug doxil with their polymer-drug conjugate, to translate the mechanisms of polymer-assisted drug delivery and controlled release at molecular scale. All molecular systems underwent geometry optimization using DFT in Gaussian-16. Frontier molecular orbital energies, including highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO), were calculated alongside reactivity electronic calculations such as electronegativity, chemical hardness and electrophilicity. Comparative electronic analyses such as hardness, softness, and chemical potentials were conducted on the polymer, doxil drug, and the polymer-drug conjugate to evaluate conjugation effects on drug-polymer interactions relevant to drug delivery efficiency. The polymer exhibits a wide HOMO-LUMO energy gap, indicating high structural stability. Doxil shows enhanced electronic reactivity due to its conjugated aromatic framework. Upon conjugation, the polymer-doxil system displays a significantly reduced energy gap, lower chemical hardness, and increased electrophilicity, suggesting improved charge transfer, stronger molecular interactions, and favorable conditions for controlled drug encapsulation and release. These results highlight the role of polymer conjugation in modulating drug electronic properties. The research presents a computationally driven framework linking DFT-derived electronic calculations with polymer-assisted drug delivery behavior, offering molecular-level insight into how polymers can enhance the performance of clinically established anticancer drugs. The study demonstrates the utility of Gaussian-16-based DFT analysis as a tool for designing next-generation polymer-drug delivery systems. The results are matched exactly with experimental drug encapsulation and delivery results.

Keywords: Density Functional Theory (DFT), Gaussian-16, drug delivery, HOMO-LUMO, electronic-calculation

CGEP09

â€œHigh-Performance Green Synthesized CuO Nanoparticles for Photocatalytic Degradation and Energy Storage Applicationsâ€.

Mahavan L[1] and Nagoor Meeran M[1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai, Tamil Nadu, India.

Abstract

Copper oxide (CuO) nanoparticles have emerged as a hot issue due to their distinctive physicochemical characteristics and the broad spectrum of applications in environmental clean-up and biomedical industries. CuO nanoparticles were synthesized by green method of synthesis which depends on plant extracts to reduce and stabilize the nanoparticles without utilizing hazardous chemicals, therefore no pollution is caused to the environment. Systematic characterization of the biosynthesized CuO nanoparticles was carried out with standard analysis methods to refine the structural, morphological, and optical properties, assisting in ascertaining the quality and purity of the material. The nanoparticles were photocatalysts; functionality was determined by assessing the ability to degrade dyes in simulated sunlight. Strong catalytic activity was observed, explained by increased surface reactivity and charge transfer. Biomedical potential was investigated by studying antimicrobial and cytotoxic properties. The experiments demonstrated potential in medical usage. Electrochemical characteristics for energy-storage were also analyzed. CuO based electrodes showed positive capacitance, cycling stability, and effective charge storage. Collectively, the results prove that green-synthesized CuO nanoparticles are versatile agents, promising for environmental cleanup, medical therapies, and high-energy-density energy-storages. The significance of the green-synthesis approach for cost-effective, environmentally-friendly nanomaterials with excellent functional properties is highlighted.

Keywords: green approach; photocatalytic activities; antimicrobial activity; cytotoxicity; antioxidant activity; supercapacitor.

CHEP10

Scalable Synthesis of High-Entropy Layered Double Hydroxides for Next-Generation Alkaline Water Electrolysis

Kamali T[1] and Silambarasan A [1*]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai

Abstract

The development of efficient and durable oxygen evolution reaction (OER) electrocatalysts is crucial for sustainable hydrogen production through water electrolysis. Layered double hydroxides (LDHs) have been extensively studied for this purpose; however, their catalytic performance is often restricted by limited elemental diversity and sluggish charge transfer. In this work, we report the design and hydrothermal synthesis of high entropy layered double hydroxides (HE-LDHs) incorporating Ni, Co, Cr, Fe and Zn. The synergistic incorporation of multiple cations within a single layered structure and further subjected to formamide treatment to investigate solvent-induced structural modulation and its impact on OER performance. Structural and morphological analyses confirm the formation of well-defined nanosheet architectures with large surface area and uniform elemental distribution. Electrochemical evaluation in 1 M KOH reveals superior OER activity with lower overpotential of 290 mV at 50 mA cmâ»Â² and a Tafel slope of 78 mV dec 1. This study positions delaminated HE-LDHs as a versatile and promising class of catalysts for scalable energy conversion technology.

Keywords: High entropy layered double hydroxides, Oxygen evolution reaction, Electrocatalysis

CHEP11

Synthesis, Multi-Spectral Characterization, and Antibacterial Evaluation of Octahedral Cobalt (II) and Copper (II) Schiff Base Complexes

Lavanya D [1] and Hazarathaiah Yadav C[1]

Department of Chemistry, School of Science and Humanity, Vel Tech Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai

Abstract

In the current study, we synthesized a Schiff base ligand by taking equimolar concentrations of ortho-hydroxy benzaldehyde and 2-amino 3-methyl pyridine and expanded it to its metal complex. Thermogravimetric analysis, FTIR spectroscopy, UV-visible spectrophotometry, and Â¹H NMR results for the synthesized ligand and metal complexes have been obtained and analyzed. The study also reveals the antibacterial benefits of the synthesized ligand and metal complexes, which are tested against Bacillus subtilis and Escherichia coli. Additionally, it also proves that by improving membrane penetration, it increases the lipophilicity and the chelation impact. Hence, this study reveals that the tailored metal complexes exhibit a promising antibacterial property. Molecular docking studies have been studied.

Keywords: Schiff base; Magnetic susceptibility; Spectroscopic data, Biological activity; Molecular docking;

CHEP12

Green Synthesis of Functionalized Metal Oxide Nanoparticles for Therapeutic and Environmental Remediation Applications

Poorani S [1] and Venkatramana L[1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Chennai, India.

Abstract

Green synthesis techniques are receiving more attention as a result of the growing need for sustainable and environmentally friendly nanomaterial manufacturing. Using a plant extract as a natural reducing and stabilizing agent to prevent agglomeration, zirconium dioxide (ZrOâ‚‚) nanoparticles were created in this study without the use of dangerous chemicals. This eco-friendly method not only lessens the impact on the environment but also improves the nanoparticles biocompatibility, which qualifies them for use in therapeutic and biomedical applications. Moreover, a biocompatible polymer coating was applied to the produced nanoparticles to enhance their stability, surface functioning, and possible drug-loading capacity. X-Ray diffraction (XRD), transmission electron microscopy (TEM), scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), and ultraviolet-visible spectroscopy were used to analyse the nanoparticles. The successful creation of nanoparticles with distinctive absorption peaks was verified by UV-Visible analysis. The reduction and stabilization-causing functional groups from plant phytochemicals were identified by FTIR spectra. Crystalline structure and phase purity were verified by XRD patterns, and uniform shape and evenly distributed nanoscale particles were seen in SEM and TEM micrographs. Crystallinity was retained following surface modification, according to XRD examination of polymer-coated nanoparticles. Particularly in drug delivery and anticancer research, the green-synthesised and polymer-functionalized nanoparticles showed encouraging biological promise. They also demonstrated strong photocatalytic activity, which allowed pharmaceutical effluents to be degraded effectively and demonstrated their numerous biological and environmental uses.

Keywords. Green synthesis, Zirconium dioxide, Polymer coating, Biocompatibility, Photocatalysis, Pharmaceutical effluent degradation.

CHEP13

Synthesis and spectral studies of novel Schiff base metal complexes and study of its biological aspects

Darwin R S[1] and Hazarathaiah[1]

[1]Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Chennai, India.

Abstract

In the present investigation, we have successfully synthesized a Schiff base ligand, designated (Z)-2-methoxy-6-(1-((3-methylpyridin-2-yl)imino)ethyl)phenol, via a condensation reaction involving 2-hydroxy 3-methoxy benzaldehyde and 2-amino 3-picoIine. This synthesized Schiff base ligand served as the foundational material for the fabrication of two metal complexes, namely, a Zn complex and a Ru complex. To characterize these compounds, a range of analytical techniques, including thermogravimetric analysis, elemental analysis, FT-IR spectroscopy, and 1H NMR, were employed. The antibacterial activity of the Schiff base ligand and its metal complexes (Zn,Ru) against a spectrum of bacteria, encompassing both gram-positive (Bacillus subtilis) and gram-negative (Escherichia coli) strains, was evaluated. The investigation revealed that the metal chelates exhibited stronger antibacterial activity compared to the free ligand, with enhanced effectiveness against E. coli over Bacillus subtilis. Moreover, the complexes displayed increased lipophilicity, facilitating their penetration into lipid membranes and obstructing metal binding sites on microbial enzymes. Our current research employed molecular docking techniques to investigate how the newly synthesized ligand and its metal complexes interact with protein receptor molecules. Our results highlighted the favourable binding energies and stable interactions observed with these compounds. Moreover, the study identified the most effective molecular orientations that disrupt protein functionality and identified precise binding sites between molecules and proteins, providing valuable insights for the development of improved protein-targeting compounds.

Keywords: Schiff base, Synthesis, Characterization, Biological activity, Docking studies.

CHEP14

Synthesis of Chitosan polymeric nanocomposite beads immobilized with bio-fabricated metal oxides for environmental remediation

Abdullahi Muhammad[1] and Sivarama Krishna L[1;]

[1] Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai, India

Abstract

Green synthesis of Chitosan/polyvinyl alcohol/zinc oxide (CSP@ZnO) nanocomposite using Acalypha indica (AI) leaf extract. Its physico-chemical properties have been confirmed through the XRD, FT-IR, and SEM. The crystallinity of chitosan amorphous phase and ZnO diffraction patterns were elaborated by XRD diffractogram. Morphologically, rough and irregular coral shaped SEM image was observed. Batch adsorption process was used to study adsorption of methylene blue (MB) with various parameters. The equilibrium data results are more consistent with the Langmuir adsorption isotherm model maximum adsorption capacity of 61.31 mg/g was recorded. The enthapy change, âˆ†HÂ°=50.5 KJ/mol signalling that the process is endothermic and non-spontaneous. These results indicate that bio-compactable composite has good potential for MB dye and other cationic dyes showing safe for the environment.

Keywords: Chitosan, green, methylene blue, zinc oxide

CHET01

Experimental and Theoretical Investigation of an Imidazo[1,2-a]pyridine Derivative: Synthesis, Characterization, Sensing, and DFT studies

Sharmila[1] and Divya D[1]

[1] Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology

Abstract

The development of selective and sensitive chemosensors for detecting hazardous divalent metal ions with biological relevance has attracted considerable attention. Copper is an essential trace element in humans; however, excessive CuÂ²âº levels can cause serious health disorders. In this study, an imidazole-based five-membered heterocyclic colorimetric chemosensor (SA1) was synthesized through a one-pot multicomponent condensation reaction and characterized using ESI-MS, FT-IR, Â¹H NMR, and Â¹Â³C NMR spectroscopy. The sensing performance of SA1 was evaluated against a series of metal cations to determine its selectivity and sensitivity toward CuÂ²âº ions. Comprehensive theoretical investigations were carried out using Gaussian 16, GaussView 6.0, and Multiwfn 3.8 software packages. The molecular geometry, bond lengths, and bond angles were optimized computationally, and theoretical vibrational frequencies were calculated and correlated with experimental FT-IR data to confirm structural features. Electronic transitions and photophysical properties in different solvents, including acetonitrile, DMSO, ethanol, methanol, and THF, were analyzed using time-dependent density functional theory (TD-DFT), and the HOMO LUMO energy gap was determined. Fukui function analysis was employed to identify reactive sites, while electron localization function (ELF), reduced density gradient (RDG), and localized orbital locator (LOL) analyses were used to investigate topological characteristics. Donor acceptor interactions were examined through natural bond orbital (NBO) analysis, and molecular electrostatic potential (MEP) mapping was performed to identify potential bioactive regions.

Keywords: Imidazole-based chemosensor, Copper detection, Colorimetric sensing, TD-DFT analysis, Reactive parameters

CHES01

Green Synthesized Bismuth Oxide Nanoparticles as Efficient and Reusable Lewis Acid Catalysts for Knoevenagel Condensation under Mild Conditions.

Yahaya Saidy [1] and Edayadulla N [1]

[1] Department of Chemistry, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology

Abstract

Bismuth oxide (Bi2O3) nanoparticles were synthesized via an eco-friendly green route (using Couroupita guianensis petal extract) and used as an efficient, and reusable Lewis acid catalyst in Knoevenagel condensation under mild conditions. Plant derived phytochemicals acts as reducing and stabilizing agents, replacing the use of hazardous reagents. The structural and physicochemical properties of the nanoparticles were determined by XRD, FTIR, UV-Vis spectroscopy, FESEM/EDS, and TGA, revealing crystalline, thermally stable, and uniformly distributed nanostructures. The catalytic performance will be evaluated on various aldehydes having active methylene compounds, expecting to produce excellent yields within short reaction times at low or ambient temperatures. The Nano sized Bi2O3 having active sites and large surface area acting as a strong Lewis acid. The catalyst demonstrates good recyclability with minimal loss in activity over multiple usage. The study highlights a sustainable nanocatalytic system encompassing green synthesis, operational simplicity, and environmentally benign organic transformation.

Keywords: Couroupita guianensis, Knoevenagel condensation, Lewis Acid

MATP01

Quantifying Miner Node Fragility: A Multi-Phase Stochastic Model of Blockchain Reliability under Volatility-Driven Arrivals

Azhar Mohamed M [1] and Somasundaram B[1]

[1] Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology

Abstract

This research presents a novel reliability-aware MAP/PH/1 framework designed to quantify the operational fragility of blockchain miner nodes. Recognizing that idealizing miners as "always-online" entities leads to significant latency underestimation, we propose a three-phase service process integrated with a Volatility-Driven Markovian Arrival Process (MAP). The model explicitly characterizes the stochastic transitions between computational hashing (P1), logical verification (P2), and network propagation (P3). Unlike traditional models, our framework incorporates a disruptive failure and repair cycle in the hashing phase and a dual-exit logic for propagation. Specifically, we introduce a Byzantine Retry Mechanism governed by a Retry Analyzer to simulate network resilience, alongside a Complete Failure path that triggers a global system restart. By mapping market-induced transaction surges (CVI-driven) to internal hardware and network vulnerabilities, this study provides a granular view of "wasted computational effort." Numerical results demonstrate that the interplay between Byzantine re-stimulation and logical satisfaction thresholds is critical for maintaining mempool stability in decentralized environments.

Keyword: Volatility-Driven MAP, Byzantine Retry Mechanism, Operational Fragility, PH-Type Service Process, Wasted Computational Effort, Mempool Stability Analysis

MATP02

Retrial Queueing Inventory Management and Sale of Smart Products with Add on Facility for Additional Features

Kavita A P[1] and Viswanath J [1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Chennai, India.

Abstract

Nowadays, many purchases are not completed on the first attempt due to unmet customer expectations. The inclusion of additional features complicates the service process and increases the system cost however, it simultaneously attracts more customers to the system and helps enhance total system revenue. This real-world situation motivates the modelling of an inventory system to predict the associated system costs. Accordingly, a stochastic queueing inventory model is initiated with the novel inclusion of customers who wait and retry after booking a basic product to fulfill their requirement of additional features. Arriving customers are directed to orbit if the WTH I in front of the SER I, which provides service for either the purchase of a basic product or booking additional features, is full. A fraction of customers may leave the system after purchasing the basic product, while the remaining customers enter the WTH II after booking for additional features. Once the booking is completed, the item will be immediately transferred to the EFFC for fitting and delivery. The Markov structure of the system is identified as a six-dimensional Markov process. The classical matrix geometric method is employed to obtain the systems long run state probabilities, and system stability is derived.

Keywords: Queueing inventory system, Retrial facility, Add on features facility, Blocking customers, Matrix geometric method

MATP03

Smart Electric Vehicle Charging Network Modeled as a MAP/PH/2 Double Orbit Retrial Queueing System with Hybrid Vacation and Intelligent Optimization

Hari Krishnan K[1] and Somasundarm B[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Chennai, India.

Abstract

The paper investigates a complicated queueing system MAP/PH/2 two heterogeneous servers, double-orbit retrial (finite premium orbit and infinite ordinary orbit) and hybrid vacation policy incorporating working and complete vacations. Customers arrive in accordance with Markovian Arrival Process (MAP) and, when both servers are occupied, are routed to orbits as per a certain probability. Retrials are orbit-type specific and are governed by an exponential distribution. Server activities are governed by a vacation policy that invokes an active or an entire vacation when the system is idle. The paper employs a matrix analytic technique to derive a steady state solution, to derive crucial performance measures, including orbit size and server utilization. Numerical experiments are conducted to validate the analytical results. Furthermore, an ANFIS approach is used to compare the numerical results obtained from the analytical method with the ANFIS-based results. The optimal social net benefit and the optimal joining probability were computed using the metaheuristic techniques Particle Swarm Optimization (PSO), Cuckoo Search Algorithm (CSA) and Genetic Algorithm (GA).

Keywords: Markovian arrival process, Phase type service, Multi server, Double orbit retrial, Hybrid vacation, ANFIS, Metaheuristic optimization.

MATP04

Smart Technical Support Systems with Retrials, Two-Stage Service, and Dynamic Failures

Hemavathi G[1] and Dora Pravina C T[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Chennai, India.

Abstract

In modern AI-assisted customer support and intelligent helpdesk platforms deployed by organizations such as IBM and Microsoft, customer requests are typically processed by a centralized single AI processing engine that serves requests sequentially, naturally forming a single-server system. Each request first undergoes mandatory automated screening through a chatbot, representing the mandatory service (MS), which includes issue identification, authentication, and basic troubleshooting. After this stage, only a fraction of requests require escalation to specialized assistance, constituting the optional service (OS) involving detailed diagnostics or configuration. When the server is busy, arriving requests join a virtual callback queue and retry after random intervals, exhibiting retrial behavior. Moreover, unexpected disruptions such as software failures, overload, or infrastructure issues, modeled as breakdowns, reduce service capacity. During these periods, the server operates at a degraded rate and provides only the mandatory service, while optional services are temporarily suspended except for ongoing tasks. After recovery, normal processing resumes. Thus, the proposed single-server retrial queue with mandatory optional services and disruptions offer a realistic and practical framework for analyzing delay, congestion, and reliability in intelligent customer support environments.

Keywords: AI-assisted customer support, Retrial queue, Mandatory service, Optional service, Server disruptions.

MATP05

Adaptive Priority Analytics for Enterprise Cyber Defence: A Two-Class Queueing Framework

Kamala P[1] and Dora Pravin C T[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

An attractive and practically relevant application of the proposed queueing system is found in a cybersecurity intrusion detection and log-processing server within an enterprise network. In this setting, a single analysis engine handles two types of tasks: high-priority real-time security alerts and low-priority background log analytics. Critical alerts, including suspected intrusions, malware detections, and unauthorized access attempts, must be analyzed immediately and therefore pre-empt ongoing background processing; this behavior is appropriately modeled as a pre-emptive priority M/M/1 queue. At the same time, routine system logs, audit trails, and performance records accumulate and are processed in batches. The analysis engine selects the batch containing the oldest pending log entry and processes all logs within that group during a fixed analysis cycle. The service time depends mainly on the allocated analysis window rather than on the number of logs in the batch, reflecting the Israeli queueing discipline. Due to storage and buffer limitations, only a finite number of log groups can be maintained. Additionally, logs may expire or be discarded if not processed within a specified time limit, representing impatience. This framework enables evaluation of alert responsiveness, backlog growth, and data loss probabilities.

Keywords: Cybersecurity Intrusion detection, Log processing, Pre-emptive priority, M/M/1, Israeli queue, Impatience

MATP06

A SECURE IMAGE ENCRYPTION AND DECRYPTION SCHEME USING HAAR WAVELET TRANSFORM

Abinesh S [1] and Venkatesan A [1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062, Tamil Nadu, India

Abstract

In this presentation, a scheme for image encryption and image decryption based on the Haar wavelet transform is proposed. The proposed scheme ensures the security of image communication. It offers efficient image encryption and image decryption. In this scheme, a multi-resolution analysis based on the Haar wavelet transform is used to decompose the image into sub-bands. Then, encryption based on keying the sub-bands and image decryption based on the inverse Haar transform are proposed. This scheme results in efficient image encryption and image decryption due to its high sensitivity to key changes and its applicability to image and video communication. During encryption, a combination of key and image blocks based on the Haar transform is used. It ensures high security and low computational complexity. Therefore, the proposed scheme based on the Haar wavelet transform can be applied to image and video communication. Better security and higher processing speed are available over various other image encryption schemes based on spatial domain methods. Essentially, this scheme based on image encryption and image decryption using the Haar wavelet transform is found to be efficient.

Keywords: Wavelets-Cryptography- Data encryption- Image Processing.

MATP07

Well-Posedness, Stability, and Controllability of Caputo Hadamard Fractional Differential Equations with Pantograph Delay

Anushree S[1] and Gunasekar T[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

This study investigates Caputo Hadamard fractional differential equations with pantograph delay arguments. Conditions ensuring the well-posedness of the system are established using fixed point techniques. The stability of the system is examined in the Ulam Hyers sense, and controllability is demonstrated through an appropriate fixed-point framework.

Keywords: Fractional derivative of Caputo Hadamard; Boundary value problem; pantograph delay, Fixed point theorem.

MATP08

A Deep Learning Physics Informed Neural Networks for Solving Nonlinear Orbital Motion Equations in Satellite Dynamics

Mohamed Ashik S[1] and Gunasekar T[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Orbital motion equations constitute the fundamental mathematical framework for modeling satellite trajectories and space mission dynamics. These equations derived from Newton's law of gravitation form a nonlinear second-order ordinary differential system commonly referred to as the two-body problem. Traditional numerical integrators such as Runge Kutta schemes provide high accuracy approximations but may suffer from cumulative discretization errors and reduced stability in long term propagation. In this study we propose a Physics Informed Neural Network (PINN) framework to solve the orbital motion equations by embedding the governing dynamical laws directly into the loss functional. The neural network architecture is constructed to satisfy initial conditions and minimize the residual of the differential equation thereby ensuring physical consistency. A comparative graphical analysis with the analytical solution demonstrates strong agreement and stable convergence. The results highlight the potential of PINNs as a robust mesh free alternative for satellite trajectory prediction and computational astrodynamics.

Keywords: Physics-Informed Neural Networks; Orbital Motion Equations; Satellite Dynamics; Nonlinear Ordinary Differential Equations; Scientific Machine Learning.

MATP09

Dynamic behaviour of rabies transmission between dogs and humans using A Caputo-Fabrizio Fractional-Order Model and Analysis of Control Strategies and Disease Dynamics

Anusha M[1] and Dora Pravin CT[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Rabies is a deadly Zoonotic infection that is mostly passed on by bites of infected dogs and is hazardous to the life of dog and human beings. This paper conducts a study to develop a 13-compartment fractional -order mathematical model that would examine the transmission dynamics of rabies between dogs and humans. The model includes the important epidemiological classes and is developed with the Caputo-Fabrizio fractional derivative to consider the memory effect in disease development. The qualitative behavior of the system is studied with the identification of disease-free equilibrium and endemic equilibrium points. Basic reproduction number is obtained to evaluate the minimum condition to sustain the disease. Moreover, the uniqueness and existence of solutions are determined with the help of the fixed-point theorem. The analytical results are confirmed by the use of numerical simulations to simulate model parameters using MATLAB and demonstrate how model parameters affect the dynamics of rabies transmission. The proposed work offers a mathematical model which can help the government agencies in charge of the general health to formulate an effective vaccination and control campaign. The results will help enhance the understanding, decrease the rabies-related death rates, and facilitate the evidence-based decision-making on the community health protection.

Keywords: Mathematical modeling, Fractional-order model, Basic reproduction number, Fixed-point theory, Numerical simulation.

MATP10

Matrix-Analytic Analysis of a MAP/PH/1 Queuingâ€“Inventory System with Opportunistic Replenishment and Server Vacation

Hariprasath M[1] and. Somasundaram B[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

This study extends opportunistic queuing inventory models by incorporating server vacation into a MAP/PH/1 framework. Customer arrival follows a Markovian Arrival Process (MAP), allowing correlated inter-arrival times, while service times are follows phase-type (PH) distributions. Customer demands occur in batches and deplete inventory upon allocation. Replenishment opportunities arise according to a Poisson process. The joint dynamics of queue length, inventory level, arrival phase, service phase, and vacation state are formulated as a structured quasi-birth-and-death (QBD) process. Matrix-analytic methods are employed to derive stability conditions and obtain the steady-state distribution in matrix-geometric form. Performance measures including mean system size, loss probability, mean inventory level, server utilization, and vacation frequency are evaluated. Numerical illustrations demonstrate how server deterioration significantly influences congestion and stock-out behavior under opportunistic replenishment policies.

Keywords: Queuing inventory system; MAP arrivals; PH service; Opportunistic replenishment; Server vacation; QBD process; Matrix-geometric solution; Performance measures

MATP11

Mathematical Analysis and Numerical Simulation of Variable Order Fractional Equations for 6G Communications

Jaya priya D[1] and Gunasekar T[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

In this work, a novel variable order fractional differential equation is proposed to analyse adaptive memory dependent 6G communication signals. The proposed model incorporates time varying memory behaviour, nonlinear channel distortion, and hereditary fading effects through a Caputo variable order fractional operator with a nonlocal boundary condition. By employing fixed point theory, sufficient conditions for the existence and uniqueness of solutions are established. The existence of solutions is obtained using Schauder's fixed point theorem, while uniqueness is ensured through the Banach contraction principle. Furthermore, a numerical scheme is developed to validate the theoretical results and demonstrate the convergence of the obtained results. The constructed framework provides a mathematically rigorous and physically interpretable approach for complex 6G communication environments with potential applications in terahertz communication, adaptive wireless networking, and intelligent Internet of Things (IoT) systems.

Keywords: Variable-order fractional calculus; Fixed point theorem; Numerical approximation; 6G communications

MATP12

Computational Analysis of Fractional - Order Mathematical Modeling of Vascular Dementia using Deep Neural Networks

Sumaiya Banu S S[1] and Gunasekar T[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Vascular dementia is a major neurodegenerative disorder predominantly found in the older population where damaged blood vessels or reduced blood flow to the brain lead to progressive cognitive impairment and neurological deterioration. This paper describes a fractional order mathematical model to project the dynamics of vascular dementia. A compartmental model is constructed to show the stage-wise progression of the syndrome. Caputo fractional-order derivative is incorporated into the system of equations to effectively capture the long-term memory dependency. Numerical simulations are conducted for various fractional orders using iterative methods. The generated dataset is split into 75% for training and 25% for testing the proposed deep neural network. The effectiveness and precision of the computation model are evaluated through mean square error and visualized graphically using various evaluation plots.

Keywords: Vascular Dementia, Fractional Mathematical Modeling, Caputo Fractional Derivative, Deep Neural Network

MATP13

Mathematical Analysis of Streptococcus pyogenes Dynamics Incorporating Pseudo-Recovery and Memory Effects Using the Fractal-Fractional Caputoâ€“Fabrizio Derivative

Swetha R[1] and Gunasekar T[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Streptococcus pyogenes is a significant bacterial pathogen responsible for a broad spectrum of illnesses, ranging from mild throat infections to severe and life-threatening invasive diseases, thereby posing a serious global health challenge. In this study, a novel fractal-fractional mathematical framework based on the Caputo-Fabrizio derivative is developed to investigate its transmission dynamics. Unlike conventional integer-order models, the proposed approach effectively captures memory and hereditary effects, offering a more realistic representation of disease propagation and control strategies. The model consists of a system of fractal-fractional differential equations that describe the complex temporal interactions governing the epidemic process. Mathematical rigor is ensured by establishing the existence and uniqueness of solutions through fixed-point theory, while the system's Ulam-Hyers stability is demonstrated to confirm robustness against small perturbations. For numerical implementation, a modified Adams-Bashforth scheme is employed, which efficiently handles the nonlocal characteristics of the Caputo-Fabrizio operator. Furthermore, the model is calibrated using real epidemiological data, showing strong agreement between simulated outcomes and observed trends. The numerical findings reveal that fractional parameters significantly influence epidemic behavior, leading to delayed outbreak peaks, prolonged infection persistence, and reduced healthcare burden. These results highlight the effectiveness of fractal-fractional modeling in understanding complex infectious disease dynamics and supporting informed public health decision-making.

Keywords: Streptococcus pyogenes; Fractal Fractional Caputo Fabrizio Derivative; Existence and Uniqueness;Adams-Bashforth scheme; Numerical Simulation.

MATP14

PIPRECIA-TOPSIS Method for Selecting ESG-Sustainable Business Model Innovations.

Ellammal G[1] and BalamuruganGunasekar M [1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Sustainable business innovations are essential for balancing economic growth with Environmental, Social, and Governance (ESG) responsibilities. However, selecting the most suitable ESG-oriented innovation is a complex decision-making task due to multiple conflicting criteria, vagueness, and uncertainty in real-world evaluations. To address this issue, this study proposes an integrated Tripolar Complex Fuzzy PIPRECIA TOPSIS multi-criteria decision-making model for evaluating and selecting sustainable business innovations. The Tripolar Fuzzy Set framework is employed to represent positive, neutral, and negative membership degrees, allowing more realistic handling of uncertain and imprecise ESG information. In the proposed approach, the PIPRECIA method determines the relative importance weights of ESG criteria, while the TOPSIS technique ranks alternatives based on their closeness to the ideal sustainable solution and distance from the negative ideal solution. Five innovation alternatives are assessed using key ESG indicators, including carbon emission reduction, resource efficiency, social impact, stakeholder well-being, and governance transparency. The findings show that the proposed model provides a systematic, flexible, and practical decision-support framework that improves the accuracy and reliability of ESG-based sustainable innovation selection under uncertainty.

Keywords: Tripolar complex fuzzy set, ESG, business model innovations, PIPRECIA-TOPSIS, Multi-criteria decision-making.

MATP15

VARIOUS FORMS OF GENERALIZED FUZZY OPEN SETS

Narayanan E[1] and Chandiran V[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

An open set in a classical topological space was extended to a fuzzy open set in fuzzy topological space using fuzzy membership function. Many forms of fuzzy open sets are defined in the fuzzy topological space.

Keywords: fuzzy open sets, fuzzy closed sets and fuzzy topological space.

MATP16

Enhancing Perishable Logistics: Adaptive Dynamic Routing with Time Windows and Transshipment Strategies Using Lamarckian Evolutionary Algorithm

Sharmila N[1] and Balamurugan M[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Distribution allocation is the strategic process of determining the optimal quantity and routing of products from supply points to demand points to minimize total logistics costs while maintaining required service levels. This paper analyses vehicle transportation time in the logistics network for perishable products, aiming to ensure timely delivery and reduce product deterioration. A mathematical model is proposed for a closed-loop supply chain network, incorporating the Location Inventory Routing Problem (LIRP) to effectively manage perishables. The direct shipment distribution model is used to determine the most efficient transit time for logistics transportation. The proposed model was then solved using appropriate optimization tools and a tailored algorithm. A numerical example is presented to demonstrate the model's effectiveness in optimizing delivery time and enhancing logistics performance for perishable goods. The results indicate that the proposed model significantly outperforms traditional approaches in terms of efficiency and reliability.

Keywords: Perishable products; Distribution allocation; Location-Inventory-Routing problem; network optimization; Time Windows

MATP17

Various Forms of Pairwise Fuzzy Open Sets

Ashokhumar P[1] and Chandiran V[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

An open set in a topological space was extended to a fuzzy open set in fuzzy topological space. Further, fuzzy topological space is generalized to generalized fuzzy bitopological space. Various different forms of generalized fuzzy open sets are studied in this extension.

Keywords: Fuzzy open set, Fuzzy bitopological space and generalized fuzzy open set

MATP18

Cost Optimization of Sustainable Ameliorating Inventory Dynamic System with Green Demand Decay and Quality Driven Pricing

Deepika G[1] and Viswanath J[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Inventory management of quality enhancing items becomes more complex as demand declines and selling prices rise with ageing. Raw material constraints and production capacity further challenge sustainable operations for ameliorated products like ghee, honey, and wine. This study develops a production inventory model for ameliorating items, focusing on ghee production from multi-location milk collection, incorporating size variations from purification, processing, and ageing to optimize system profit.

Keywords: Three echelon inventory, , Quality Enhancement, Aging, Cost Optimization

MATP19

Performance Analysis of a Cognitive Wireless Retrial Queueing Network with Energy Harvesting and Channel Failure Repair Mechanisms.

Suganya T[1] and Sankar R[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

This paper presents an enhanced retrial queueing model for evaluating the performance of Cognitive Radio Networks (CRNs) with energy harvesting capability. A single-channel server is shared by primary (licensed) users and secondary (unlicensed) users under priority access. When a primary user arrives, the service given to a secondary user is interrupted and resumed only after completion of the primary transmission. After every service completion of both PU and SU, the server enters an energy harvesting state, where energy is collected from RF (Radio Frequency) signals, solar and wind sources. The harvesting rate significantly affects idle probability, orbit size and waiting time. Existing studies assume that the server is always reliable during harvesting. However, realistic wireless hardware may also fail during the harvesting phase. Therefore, we introduce a new breakdown mechanism specifically during the energy harvesting period. In case of breakdown, the system immediately enters repair mode, and after repair, the server becomes idle before continuing normal operation. The model is formulated using a Continuous-Time Markov Chain (CTMC), and the performance indicators are derived using generating function techniques. Finally, comprehensive numerical results and graphical analyses are presented to provide insights into the proposed scheme.

Keywords: Cognitive Radio Network, Retrial Queues, Energy Harvesting, Channel Failure, Repair Mechanism.

MATP20

Fuzzy Graph /Bipolar fuzzy resolving set and its application

Sangeetha P[1] and Shanmuga Priya R[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Many real-world network systems, such as social networks, epidemic models, decision-making frameworks, and communication structures, inherently involve uncertainty and dual behavioral characteristics. Traditional fuzzy graphs represent uncertainty using a single membership function; however, they do not simultaneously capture both positive and negative degrees of association. To overcome this limitation, the concept of a Bipolar Fuzzy Graph (BFG) integrates positive membership values, which represent supportive or cooperative relationships, and negative membership values, which denote conflicting or inhibitory interactions. This framework is widely applied in decision-making, game theory, and artificial intelligence to manage contradictory or dual-information scenarios. In graph theory, a resolving set is a subset of vertices that uniquely identifies every other vertex based on its distances to the vertices in the set. Extending this concept to bipolar fuzzy graphs enhances its applicability and analytical power, as it incorporates both positive and negative membership information to effectively handle uncertain, incomplete, or inconsistent data.

Keywords: Cubic fuzzy graph, cubic fuzzy resolving set, cubic fuzzy resolving number strength of connectedness

MATP21

Existence and Uniqueness of Fixed Points in Fuzzy Metric Spaces

Sithsabesan S[1] and Kalaivani N[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Fixed point theory in fuzzy metric spaces provides a powerful mathematical framework for analysing nonlinear mappings in environments characterized by uncertainty and imprecision. Classical metric approaches often fail to adequately represent real-world systems involving vagueness, motivating the extension of contractive principles to fuzzy settings. In this work, we establish new generalized contractive-type fixed point theorems in fuzzy metric spaces. The proposed results guarantee the existence and uniqueness of fixed points for a broader class of nonlinear mappings and ensure convergence of associated iterative sequences. Our approach extends and unifies several existing results in the literature while offering improved conditions for convergence analysis. These findings significantly enhance the theoretical foundation of fuzzy mathematics and contribute to its practical applicability in fuzzy control systems, image processing, and decision-making models under uncertainty.

Keywords: Fixed Point Theorem, Fuzzy metric space, Convergence Analysis, Nonlinear Mappings, Uncertainty Modeling

MATP22

A Computational Framework for Thyroid Cellular Systems under Neutrosophic Fuzzy Uncertainty

Devika P[1] and Senbagamalar J[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

The paper introduces a neutrosophic fuzzy method which uses graph theory to discover and construct thyroid cellular systems. The three primary types of thyroid cells, namely follicular, parafollicular, and capillary cells, are considered, with their structural and functional characteristics which medical imaging and tissue analysis systems measure with imperfect information. The researchers employed neutrosophic fuzzy sets to express these intricate phenomena through mathematical frameworks which define cellular attributes and their relationships with various degrees of truth and uncertainty and falsehood. The proposed model uses graph vertices to represent thyroid cells while it models their biological and structural connections through edges which display neutrosophic fuzzy membership values. The system allows users to include uncertainty elements into their network design process. The research team performed eigenvalue analysis on the resulting neutrosophic fuzzy graph to study core system characteristics which include connectivity structures and system stability and the way uncertainty spreads through the cellular network. The analysis establishes how single cell characteristics affect network performance. The combination of neutrosophic fuzzy logic with graph-theoretical approaches and spectral analysis produces a clear and strong system which effectively distinguishes between different types of thyroid cells. The study establishes exact mathematical principles to design complex thyroid cellular systems which enable research development in computational endocrinology and biomedical graph analysis.

Keywords: Neutrosophic fuzzy graph, thyroid cell systems, uncertainty propagation, modeling of complex thyroid cellular systems.

MATP23

Geometric Properties of Normalized Rabotnov Functions with Applications to Cardiac signal Stability

Deepika C[1] and Stalin T[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

This study investigates the geometric properties of a normalized Rabotnov function within the open unit disc. A particular linear combination involving the Rabotnov operator establishes a new subclass of analytic functions. We derive sharp coefficient estimates, determine extremal functions, and establish growth and distortion theorems for this class. Additionally, we apply Littlewoods subordination theorem to derive integral means inequalities. The major contribution of this study is the application of these geometric results in biomedical signal processing. We propose a Signal Relative Index, which depends on the growth bounds, to provide a safe geometric zone for Electrocardiogram signals. Furthermore, we apply the distortion theorem to establish constraints on velocity, which gives us a means to determine the difference between healthy heartbeats and pathological artifacts based on the properties of the Rabotnov function.

Keywords: Rabotnov function, Coefficient estimates, Growth and distortion.

MATP24

HEPATITIS C VIRUS TRANSMISSION MODELING AND STABILITY ANALYSIS WITH CLINICAL OUTCOMES

Jayaprakash M[1] and Naresh kumar J[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

The main reason for liver-based infections like liver cirrhosis, liver cancer, and liver failure is the hepatitis C virus HCV. It is one of the major causes of the high mortality rate worldwide because its symptoms are mild, like fatigue, nausea, and jaundice, in longterm situations, they may experience fluid accumulation in the belly and bruise easily. People do not recognize these symptoms are critical one, they are simply visiting the hospital to get short term relief of these symptoms. In this work, we formulate a compartmental model for analyzing the diseases transmission dynamics and to examine methods for controlling outbreaks by calculating the basic reproduction number and the disease-free equilibrium. The model analysis demonstrates whether the disease-free equilibrium is asymptotically stable both locally and globally. To demonstrate the model's behaviour, we provided numerical simulations using MATLAB.

Keywords: HCV, stability, equilibrium points, reproduction number.

MATP25

Trapezoidal Valued Pythagorean Fuzzy TOPSIS Framework Based on Aczel Alsina Aggregation Operator

Angel J[1] and Kaviyarasu M[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

The rapid growth of fake news on internet platforms has resulted in a high need for dependable AI based fake news detection systems. However, choosing the ideal AI model is difficult because expert opinions are frequently imprecise, ambiguous, and subjective. So, this paper gives an new method for making decisions based on trapezoidal valued Pythagorean fuzzy data. We begin by introducing basic mathematical procedures for trapezoidal valued Pythagorean fuzzy numbers using the Aczel Alsina operator. Then, various novel geometric aggregation operators are introduced, and their key properties are addressed. These operators are used to build a trapezoidal valued Pythagorean fuzzy TOPSIS algorithm. The proposed methods efficacy is proven by a real-world example of picking the best AI based fake news detection model. Finally, sensitivity and comparison analysis demonstrate that the suggested strategy is stable, dependable, and effective.

Keywords: Trapezoidal valued Pythagorean fuzzy set, Geometric operator, TOPSIS Method, Aczel-Alsina aggregation operator

MATP26

Geometric investigations of a novel subclass of univalent functions involving Mittag-Leffler operator

Supprabha A[1] and Stalin T[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

In this paper, we propose new subclass within the class of univalent functions. These subclasses are defined using a Mittag-Leffler type operator associated with Poisson distribution series. The primary goal of this research is to gain a better understanding of the functions that comprise these newly proposed subclasses, as well as to derive useful analytical results. In this context, we investigate coefficient bounds, identify extreme points, establish integral mean inequalities, inclusion property and demonstrate the growth and distortion theorem, starlike and convex nature. In addition, we investigate the Integral operator related to Mittag-Leffler type Poission distribution series. All findings were obtained within the framework of the open unit disc.

Keywords: Fractional integral operator, Mittag-Leffler Poission distribution series,starlike,convex,close-to-convex

MATP27

Cost Optimization of a Two-Threshold Incineration Model for Energy Conversion in Solid Waste Management Using Queueing Theory

Aswini K[1] and Niranjan S P[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

This study models waste-to-energy incineration using a two-threshold framework that governs the operational state of the combustion system and its ability to convert solid waste into usable energy. The first threshold is the calorific-value threshold, which determines whether the waste contains sufficient energy content to sustain combustion without auxiliary fuel. The second is to moisture-content threshold, which controls whether the waste can ignite and maintain furnace temperature without excessive heat loss. When both thresholds are satisfied, the system enters a positive-flow state, where the incinerator operates smoothly and yields stable energy output. When both thresholds fail, the system moves into a negative-flow state, representing full operational failure, combustion instability, and zero usable energy conversion. If only one threshold is satisfied, the system enters a partially negative-flow state, where incineration occurs intermittently or inefficiently, producing reduced energy with higher processing delays and greater need for preprocessing. This two-threshold structure provides a mathematically tractable way to characterize how waste properties influence operational stability, queue dynamics, and overall energy performance within solid-waste management systems.

Keywords: Solid waste management, Waste-to-energy incineration, Calorific-value threshold, Moisture-content threshold, Cost optimization

MATP28

Circular Pythagorean Neutrosophic Fuzzy Hamacher Aggregation Based Algorithm for Renewable Energy Decision Analysis

Venitha R[1] and Kaviyarasu M[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

This work proposes a multi-criteria decision-making framework based on the Circular Pythagorean Neutrosophic Fuzzy Set integrated with Hamacher aggregation operators to effectively manage uncertainty and ambiguity in complex decision-making environments. The proposed circular structure simultaneously captures the degrees of truth, indeterminacy, falsity, along with the radius of uncertainty, offering a more symmetric and geometrically interpretable representation of imprecise information. Hamacher t-norm and t-conorm operations are employed to develop parameterized aggregation operators, providing enhanced flexibility to model various interactions among decision criteria. Several fundamental properties and theorems are established to verify the validity, consistency, and reliability of the proposed operators. The developed framework is applied to rank alternatives in a renewable energy site-selection problem, where the Desert Plateau emerges as the most suitable location for establishing solar power facilities. The results demonstrate the robustness of the proposed approach in handling inconsistent and uncertain data, confirming its effectiveness and computational efficiency compared to existing decision-making models. This study presents a unified and reliable framework for addressing circular and uncertain information in decision-support systems.

Keywords: Circular fuzzy set, Pythagorean Neutrosophic set, Hamacher aggregation operators, Decision making model, Renewable energy.

MATP29

Uncertainty - Driven Road Accident Prevention using ML & Multi-Criteria Decision Analysis

Shanthini C[1] and Narmada Devi R[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

In Today's world, road accidents are very common due to many factors, such as Vehicle condition, road environment, and driver behaviour, which are sources of uncertainty and ambiguity. Based on the classical data, predicting the accident level in these uncertain conditions is very difficult for finding the good results. In this presentation, a new structure is proposed that combines Neutrosophic Plithogenic Tree Soft Sets (NPTSS), Machine learning (ML), and the TOPSIS decision making method to improve the prediction and control of road accidents. First, collect the synthetic data for crisp values, and then convert to NPTSS value in the representation of Truth, Indeterminacy and Falsity. To predict the accident level, with the help of different models of ML, such as statistical models like Logistic Regression (LR), Naive Bayes (NB), and K Nearest Neighbours (KNN) are used to find the mathematical relationship in accident data, ensemble model like Random Forest (RF), Gradient Boosting (GB), XBoost combine multiple decision trees for stronger and more accurate predictions and deep learning models like Multi-Layer Perceptron (MLP), Convolution Neural Network (CNN), Long Short Term Memory (LSTM) are used for the complex hidden patterns from the data. Finally, in the use of model results, it shows that the NPTSS data performs better compared to the crisp data based on the uncertain or unclear conditions. Further, TOPSIS analysis was used to compare the models and interpret the accident control techniques, helping the decision maker choose the most effective preventive actions in terms of ranking. This study gives a prediction and controls road accidents by combining uncertainty aware modeling with intelligent decision-making, which can help prevent accidents from accident prediction of the risk factors, leading to the future.

Keywords: NPTSS, Machine Learning, TOPSIS, Road accident prediction and prevention, Uncertainty Modeling.

MATP30

Prediction of Weather Disaster using Machine Learning for Uncertainty Environment

Rajaannam K[1] and Narmada Devi R[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Nowadays, weather disasters significantly contribute to the suffering of both ecosystems and organizations. As in the coming decades global warming will continue, and its contribution to increasing natural disaster losses will become more esteemed. When examining the evaluation of scientific literature on inclement weather and its effects, it is prominently apparent that many different methods are experienced to make consequences. The aim of this work is to show how to easily and early predict the weather disaster. In this article a new framework is introduced for weather disasters. Neutrosophic Pythagorean Super Hyper Soft Sets (NPSHSS) are liable to tackle uncertainty using truth, indeterminacy, and falsity, which are clarified through neutrosophic aggregation operators within the SWOC (Strengths, Weaknesses, Opportunities, Challenges) deliberation matrix. Additionally, include the Machine learning models, Long Short-Term Memory (LSTM), the CNN LSTM hybrid model, and the Transformer model. Comparing the results of this model, find out the best one for weather prediction. LSTM is a special type of neural network that retains the important information for a long sequence and forgets what is not needed. This study proposes intelligent disaster prediction under uncertainty for machine learning driven NPSHSS with SWOC analysis. In the view of climatology and geometrical data, using the machine learning model, NPSHSS, with SWOC analysis in a unified mathematical structure. For early warning applications, validation on flood and cyclone data sets confirms high ranking predictive accuracy and robustness. This structure predicts the risk level based on the weighted neutrosophic seaming appliance, allowing accurate coordinate systems for predicting flood, cyclone, and mudslide events. In this work, mainly on the theoretical aspects by proceeding with the neutrosophic hyper soft theory with the integration of machine learning and basically authorize a detachable tool for prior altering systems, resource adjectives, and climate acclimation planning in disaster-stricken societies worldwide.

Keywords: LSTM Model, CNN LSTM model, Transformer Model, Neutrosophic Pythagorean Super Hyper Soft set, SWOC Analysis.

MATP31

Peristaltic transport of Jeffrey nanofluid flow under the effects of magnetic field and electroosmotic influenced by wall property

S. Imrana Jabeen[1], G M Vijayalakshmi[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

The main purpose of the present study is to investigate how the peristaltic technique of a "Jeffrey nano-fluid" operating in a vertical channel with suitable boundary conditions, is influenced by wall properties under the effects of a magnetic field and electroosmosis with slip velocity conditions. Many researchers worked on "peristaltic flow using various biological fluids," and they examined Newtonian fluids to explore the peristaltic flow process. In contrast to non-Newtonian fluids, they have garnered significant attention. The complexity of fluids has led to the emergence of various models for non-Newtonian fluids. Jeffrey fluid is one of the simplest linear models in non-Newtonian fluids since the exact or numerical solution is expected to be discovered at some point. The characteristic of nano-fluid is illustrated for electroosmosis fluid motion in the presence of a magnetic field, viscous dissipation, thermophoresis, and Brownian motion influenced by wall properties. Moreover, consider the heat and mass transfer equations for Jeffrey nano-fluid flow in a system of ordinary differential equations, the resulting system of ordinary differential equations is numerically simulated using the MATLAB software, with the assumptions of an extended wavelength and a small-scale Reynolds number, Furthermore, numerical and graphical estimates of velocity, temperature, and concentration are provided for a number of emerging parameters.

Keywords: Jeffrey nanofluid, Newtonian fluids, Brownian motion

MATS01

Cryptography in Blockchain

Karthikeyan M[1] and Vijayalakshmi G M[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

Cryptography serves as the core security foundation of blockchain technology by ensuring data integrity, authentication, and transparency in decentralized systems. As blockchain adoption expands across finance, healthcare, and digital governance, the demand for stronger and more flexible security mechanisms continues to grow. This study highlights both fundamental and emerging cryptographic techniques that enhance blockchain protection. Traditional methods such as hashing, digital signatures, and consensus algorithms provide essential safeguards for transactions and smart contracts, while new developments address evolving threats and scalability challenges. Post-quantum cryptography introduces lattice-based and hash-based algorithms designed to withstand future quantum computing risks. Privacy-focused innovations like zero-knowledge proofs enable verification without exposing confidential information, improving user trust and data protection. In addition, zero-knowledge rollups contribute to network scalability by reducing on-chain load, and artificial intelligence supports real-time anomaly detection and contract auditing. Together, these advancements illustrate a multi-layered security approach that strengthens blockchain reliability and prepares decentralized ecosystems for future technological demands.

Keywords: ZK Rollups, Post-Quantum Cryptography, Zero-Knowledge Proofs, Digital Signatures, Distributed Ledger Technology (DLT).

MATS02

Dynamics of HIV Infection Model of CD4+ T Cells

Ahmad Umar Abubakar[1] and Chandrasekaran E[1]

[1]Department of Mathematics, School of Science and Humanity, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu

Abstract

A novel nonlinear within-host HIV infection model incorporating immune exhaustion, logistic CD4âº T-cell homeostasis, and Holling type II saturation is analysed. Fundamental properties of the model are confirmed. A basic reproduction number is derived, which governs the threshold dynamics of infection invasion. The Routh-Hurwitz criterion was used to show the local stability of the disease-free state, while Lyapunov functional methods were used to assess its stability on a broader, global scale. Additionally, we propose an accurate block solver based on the block backward differentiation formula to solve the model. Stability properties of the numerical method are analysed, and the method is found to be zero stable, A-stable, consistent, and convergent. The effects of immune exhaustion and saturation on CD4âº T-cell dynamics and viral persistence are illustrated through numerical simulations. The findings show that adding biologically realistic nonlinearities results in HIV dynamics that are more stable, bounded, and clinically interpretable.

Keywords: Mathematical modelling, HIV, Numerical method

We are Passionate. Doers in Innovative Engineering Education

9 788198 799227

www.veltech.edu.in

1800 2127 669

Contact Us

Office of Research Studies,
III Floor - Research Park, Room No: 29308,
Vel Tech University, Vel Nagar, Avadi,
Chennai – 600 062, Tamil Nadu, India