ABSTRACT BOOK

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ICMA 1: Dynamics of Certain Human Body Circulations

V P Saxena

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Abstract: Human body in its in vivo state is one of the most complex physiological and anatomical systems involving large number of mechanical, chemical and biological processes. Circulation of material and energy through its constituents and inner spaces is an area that attracts scientists from various fields including applied mathematicians. Here it is intended to give an overview of certain circulations like fluid, energy, and medicinal drugs. This covers the necessary physiological and physical description of selected processes. Specific problems pertaining to fluid (e.g., blood), dermal heat transport, and drug administration through the body surface have been discussed mathematically. The impact of malignancy has also been touched upon.

ICMA 2: Homogenization of Unilateral Constraints

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Abstract: I will outline some variational models with applications to the equilibrium of hyperelastic solids subjected to kinematic constraints on many small regions, which we call perforations. Such constraints on the displacement u are given in the quite general form "$u(x)$ belongs to $F(x)$", where $F(x)$ is a closed set, and thus this model comprises confinement conditions, unilateral constraints, controlled displacement conditions, etc., both in the bulk and on the boundary of the body. The regions in which such conditions are active are assumed to be so small that they do not produce an overall rigid constraint, but still large enough so as to produce a non-trivial effect on the behaviour of the body. Mathematically, this is translated in an asymptotic analysis by introducing two small parameters: ϵ, describing the distance between the elements of the perforation, and δ, the size of the element of the perforation. We find the critical scale at which the effect of the perforation is non-trivial and express it in terms of a Γ-limit in which the constraints are relaxed so that, in their place, a penalization term appears in the form of an integral of a function $f(x, u)$. This function is determined by a blow-up procedure close to the perforation and depends on the shape of the perforation, the constraint $F(x)$, and the asymptotic behaviour at infinity of the strain energy density. If time permits, I will give a concise proof of the mathematical result and show numerical studies for some simple yet meaningful geometries.

Keywords: Variational models; Hyperelastic solids; Kinematic constraints; Γ-limit; Asymptotic analysis; Numerical studies

ICMA 3: Combinatorial Designs: An Introduction with Open Problems and t-group Divisible Designs

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Abstract: A combinatorial design is a pair (V, B) where V is a finite set and B is a collection of subsets of V. The conditions imposed on V and B provide us with different designs. For example, a group divisible design $GDD(n, m, k; \lambda_1, \lambda_2)$ is a collection of k-element subsets, called blocks, of an nm-set X where the elements of X are partitioned into m subsets (called groups) of size n each; pairs of distinct elements within the same group are called first associates of each other and appear together in λ_1 blocks while any two elements not in the same group are called second associates and appear together in λ_2 blocks. A t-(v, k, λ) design is a collection of k-subsets of a v-set V, such that every t-subset of V is in exactly λ blocks. Both GDDs and t-designs have been studied and have important applications in the field of Combinatorics. These two concepts are combined to obtain a definition of t-GDD. This new definition has the potential to raise many more generalizations and challenging existence problems. We will discuss some of these new generalizations, and show two simple but interesting constructions of 3-GDDs.

Keywords: Combinatorial design; Group divisible designs (GDD); t-designs; Combinatorics; Existence problems; t-GDD; Constructions

ICMA 4: A Unified Framework for Lowest-Order FEM for Fourth-Order Elliptic Problems

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Abstract: A unified framework for fourth-order linear and nonlinear elliptic problems with general sources allows for quasi-best approximation with lowest-order finite element methods (FEMs). The talk discusses the stability and error control in the piecewise energy and weaker Sobolev norms under minimal hypotheses. Applications include the biharmonic problem, stream function vorticity formulation of the incompressible 2D Navier-Stokes equations, and the von Kármán equations with Morley, discontinuous Galerkin, and the C^0 interior penalty schemes.

Keywords: Fourth-order elliptic problems; Finite element methods; Stability; Error control; Sobolev norms; Biharmonic problem; Navier-Stokes equations; von Kármán equations; Morley element; Discontinuous Galerkin; C^0 interior penalty schemes

ICMA 5: Role of Industrial Mathematics Towards Sustainable Consumption and Production

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Abstract: While the manufacturing industry is essential for meeting the ever-increasing needs of society, it has also created significant negative impacts on the planet. To meet these societal demands, the industry primarily relies on virgin materials from nature and non-renewable energy sources. This reliance results in the emission of various forms of waste, not only during the manufacturing phase but also throughout the product's entire life cycle. These issues have contributed to global challenges such as climate change and marine plastic pollution. This requires world to think differently and strike a balance between consumption and production which is already recognized as one of the primary goals and listed as 12th SCG. The best possible balance we could have been to maintain the limits consumption and production which are sustainable to the planet. This is where we need industrial mathematics specially the optimization and OR models specifically to manage scared natural resources during the production and consumption. This talk will discuss some of the opportunities which could be used at product, process and systems levels taken into account product life cycle perspective to achieve SCP. Some of the case studies on SCP will be discussed related to agri-food supply chain, construction industry supply chains and in the new product designs perspectives. Furthermore, the synergies between Optimization, OR and Discrete Event Dynamic System Simulation techniques will be discussed. Finally, an innovative, convergent systems approach which could greatly synergies from Industrial mathematics in future will be presented to solve complex problems of SCP.

Keywords: Industrial Mathematics; Sustainable Consumption and Production; Operations Research; Discrete Event Dynamic Systems based Simulation; Convergent systems approach

ICMA 6: Trajectory Controllability of the Fermentation Problem Using Impulsive Neutral Stochastic Functional Integrodifferential Equations Driven by fBm with Noncompact Semigroup via Mönch Fixed Point

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Abstract: Fermentation process is the conversion of sugar to alcohol under anaerobic conditions using yeast. In various industries such as fuel, reagents, feedstock, and solvents (acetone, butanol, and ethanol), fermentation products have great commercial value. These solvents are used in applications like automobile lacquers, aircraft wing dopes, and for the manufacture of lacquers, resins, rubbers, fats, and oils. In the cosmetic industry and medical pharmaceuticals, ethanol is used in alcohol production and as an anesthetic agent. This work focuses on the mathematical model of the fermentation process and its Trajectory (T) - control. The aim is to study the mild solutions for a class of impulsive neutral stochastic functional integrodifferential equations driven by fractional Brownian motion using non-compact semigroup in a Hilbert space. We assume that the linear part has a resolvent operator that is not necessarily compact, but the operator norm is continuous. Sufficient conditions for the existence of mild solutions are derived using the Hausdorff measure of non-compactness and the Mönch fixed point theorem. Furthermore, under suitable assumptions, the T-controllability of the system is established using a generalized Gronwall's inequality. An example is provided to illustrate the obtained theoretical results.

Keywords: T-controllability; Impulsive neutral stochastic integrodifferential system; Noncompact semigroup; Mönch fixed point; Resolvent operator; Growth phases of cell concentration in batch fermentation

ICMA 7: Boundedness Results for Solutions of Certain Second Order Non-Autonomous Ordinary Differential Equations

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Abstract: We consider the second order non-autonomous nonlinear ordinary differential equations of the form:

$$a(t)x'' + b(t)f(x,x') + c(t)\left[g(x') + m(x)\right]h(x') = p(t,x,x')$$

and

$$(a(t)x')' + b(t)f(x,x') + c(t)\left[g(x') + m(x)\right]h(x') = p(t,x,x'),$$

where a, b, c, f, g, m, h, and p are real-valued functions which depend at most on the arguments displayed explicitly. In this research, different forms of integral inequalities and two forms of the mean value theorem for integrals, without using the Lyapunov direct method, are applied to investigate the boundedness of all solutions and their derivatives. Results obtained improve on some earlier results in literature.

Keywords: Boundedness; Nonlinear; Second order; Integral inequalities; Differential equations

ICMA 8: Sub-Distribution Hazard Modelling of Competing Risks Data with Longitudinal Measurements

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Abstract: Analyzing data with competing risks and longitudinal measurements is challenging yet crucial for various fields. In this study, we propose an approach that addresses both aspects simultaneously. Our method extends traditional survival analysis techniques by incorporating longitudinal data through a joint modeling framework. We develop a flexible model that captures individual risk profiles over time using longitudinal trajectories as time-varying covariates. Additionally, we employ the sub-distribution hazard function to account for competing risks, enabling estimation of cause-specific event probabilities. Simulation studies will be conducted to show the efficiency of our approach, particularly in scenarios with complex longitudinal trajectories and competing risks. Applying our methodology to real-world clinical data, we explore the association between longitudinal biomarker measurements and competing risks outcomes in patients. In overall, our approach offers a practical and comprehensive framework for analyzing competing risks data with longitudinal measurements, facilitating informed decision-making and risk assessment in various fields.

Keywords: Competing Risks; Longitudinal Data; Biomarkers

ICMA 9: Modified Hybrid Approach for Direct Integration of Third and Fourth-Order Application Problems

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Abstract: Recent advancements in numerical approximation techniques have spurred the exploration of direct methods utilizing higher derivatives to tackle higher-order initial value problems (IVPs), aiming to refine numerical precision. This research introduces a third, fourth, and fifth-order derivatives, three-point implicit method to directly handle general third and fourth-order ordinary differential equations. This method showcases significant efficiency improvements attributed to the implicit block approach of higher derivatives, facilitating increased order. Formulated in a block mode, the new method enables simultaneous approximation evaluation at three points, thereby bolstering implementation robustness and facilitating straightforward computation. Comprehensive analyses of the method's characteristics, including its order, zero-stability, and

convergence, are conducted to ensure its effectiveness and suitability for addressing various problems. Numerical experiments also validate the method's applicability to problems in physics and engineering as demonstrated.

Keywords: Collocation; Convergence; Efficiency; Higher-order ODEs; Implicit-Block Mode; Initial Value Problems (IVPs); Interpolation

ICMA 10: Gambling Mathematics: Comparative Analysis of Martingale and Labouchere Betting Systems in Roulette

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Abstract: This paper presents a comparative analysis of the Simple Martingale and Labouchere betting systems applied to roulette, using extensive simulations and statistical evaluations. The investigation reveals that the profit distribution of a Labouchere round is a mixed random variable, with its continuous part approximated by the Gumbel-Gompertz distribution. Simulations highlight the intricate characteristics of the Labouchere system, offering insights into its behavior and practical implications, including scenarios with unlimited stakes.
The findings indicate distinct differences between the two systems. The Martingale system's doubling strategy can lead to rapid bet size escalation and substantial losses during prolonged losing streaks, necessitating lengthy recovery periods. In contrast, the Labouchere system involves more moderate bet size progression but requires more coups to complete a sequence, resulting in longer playing times. This underscores a crucial trade-off: Martingale offers quicker but riskier returns, while Labouchere provides a slower but potentially safer experience.
Players must consider the average bet size, time commitment, and risk exposure inherent in each system. Despite these differences, both systems ultimately converge to the same negative mathematical expectation of gain per unit wagered. Statistically, a Martingale round at roulette can be represented by a two-point distribution, allowing for precise analytical derivations. Conversely, a Labouchere round is best described as a mixed random variable with a discrete spike at each win, corresponding to the initial sequence sum. Losses in Labouchere rounds exhibit a left-skewed pattern, often modeled by the Gumbel-Gompertz distribution. Due to the Labouchere system's complexity, simulations are essential for understanding its dynamics.

Keywords: Gumbel-Gompertz Distribution; Mixed Random Variable; Simulation; Risk Analysis; Betting Strategies

ICMA 11: Discrete Chaos Using Four-Step Approximation Method with Applications

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Abstract: With a crucial capacity for chaos, nonlinear difference equations found a significant place in chaos theory with various applications in every branch of science and engineering such as weather forecasting, image encryption and decryption in cryptography, traffic control models, security systems, etc. In standard models, the chaos is controlled using a single parameter r and is called a one-step recursive system. In this article, a few dynamical properties are studied using the four-step Noor approximation method. The study is carried out using mathematical and experimental analysis. The novel added parameters increase the performance in the nonlinear dynamical system and improve the chaotic properties. The superiority in the dynamical properties such as Lyapunov exponent, periodicity, and control is examined in Noor orbit. Further, the study determines a few applications in real-life problems such as superior traffic control models, cryptography, and cardiac arrhythmia in biosciences. Moreover, it is observed that the extra degree of parameters in the four-step approximation method improves the efficiency of the existing results in the literature.

Keywords: Chaos; Control; Fixed-point approximation; Difference Equations

ICMA 12: Complex Dynamics of the System in Different Parametric Planes with Fear, Migration and Group Defense

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Abstract: Ecosystems are deeply affected by the complexity of predator-prey relationships. Within these ecosystems, prey species exhibit protective instincts that compel greeting behaviors to reduce the predation threat and help adapt their reproductive strategy. In this situation, mathematical ecosystems play a crucial role in the conservation of ecology. In the present study, we have considered two-prey and one-predator model in the Sundarbans ecosystem. We have explored the complex dynamics of the system in different parametric planes, using iso-spike and Lyapunov exponent diagrams. We have investigated several

kinds of organized periodic structures, co-existence of different types of attractors, both spike-doubling and spike-bubbling roots, to chaos, etc. We have observed how fear, group defense, and migration parameters influence the dynamic system and play a strategic role in the complete survival of the ecosystem.

Keywords: Sundarban Ecosystem; Lyapunov function; Iso-spike; Parametric planes; Migration

ICMA 13: On Some Topological Indices for the Orbit Graph of Dihedral Group

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Abstract: Let G be a group, and Γ_G the orbit graph of G, with non-central orbits in the subset of order two commuting elements in G, and the vertices of Γ_G connected if they are conjugates. The main objective of this study is to compute several topological indices for the orbit graph of a dihedral group, including the Wiener index, the Zagreb index, the Schultz index, and others. We also find a relationship between the Wiener index and the other indices for the orbit graph. Furthermore, their polynomials have also been computed.

Keywords: Orbit graph; Wiener index; Zagreb index; Schultz index

ICMA 14: Almost Pseudo Symmetric LP-Sasakian Manifold with Respect to General Connection

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Abstract: The object of the present paper is to study almost pseudo symmetric LP-Sasakian manifold with respect to general connection. In analogy with the definition of almost pseudo symmetric manifold [$(APS)_n$], an LP-Sasakian manifold is almost pseudo-symmetric with respect to general connection.

Keywords: LP-Sasakian manifold; General connection; Curvature tensor

ICMA 15: Capacitated Vehicle Routing Problem with Time Windows for Abuja Post Office

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Abstract: Transporting parcels is an acute problem for the postal delivery system. It accounts for about forty-five percent of all expenses other than personnel within the postal system. The vehicle routing problem (VRP) is the problem of finding the optimal routes of delivery or collection from one or several depots to a number of warehouses or customers. In this study, we model the Nigerian Postal Services mail delivery service as a VRP using the Abuja Post Office as a case study. This is in order to address the problem of delay in mail delivery occurring frequently in the Nigerian Postal Services. A related model is applied with modifications to solve the problem and appropriate data were obtained from Abuja Post Office. The data is used in coming up with the distance matrix. The problem is then solved with the help of Lexi-search algorithm on Excel solver, the algorithm is validated with Benchmark test data from Tsplib using C++, and we develop an integral transportation schedule for the Nigerian Postal Services which meets all demands from current inventory at minimum cost.

Keywords: Capacitated VRP; Polynomial-time; Lexi-search algorithm; Time windows; Benchmark instance

ICMA 16: Analysis of Preservation Technology based Green Supply Chain model

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Abstract: In this discussion, we will explore a method for determining the optimal order quantity of eco-friendly products, taking into account factors such as inflation, trade-credit strategy, and carbon emissions. A key challenge is that these products tend to deteriorate over time, losing their quality. We will also consider the use of preservation technology to maintain the condition of these eco-friendly items. In this scenario, the retailer supplies the green deteriorating items to the purchaser under a policy of permissible delay in payment. The buyer manages the packaging of these items to control their value and uses preservation technology to maintain their quality. Environmental inventory costs, including carbon emission costs, packing costs, and development costs, are also considered. A numerical example is provided to validate this approach. Observations from this study offer managerial insights and applications for industries.

Keywords: Greening deteriorating items; Carbon emissions; Inventory model; Preservation technology

ICMA 17: Matrices Computation in Seismic Imaging

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Abstract: The massively parallel nature of seismic data allows geophysicists to develop highly efficient algorithms for matrix-based parallel computing in high-performance systems. Non-Negative Matrix Factorization (NMF) is applied to identify unknown factors such as source locations, delays, and signal propagation speeds. To enhance seismic acquisition efficiency, simultaneous-source data is deblended into single-source responses. Techniques like Jacobian matrices for seismic tomography, AVO (Amplitude Variation with Offset), and Walsh-Hadamard matrices are used for seismic data reconstruction and denoising. Enhanced Hankel Low-Rank Matrix Estimation, along with Hilbert matrices, are critical in attenuating random noise and improving signal reliability.

Wavelet transform plays a pivotal role in nonstationary multiscale nonlinear geophysical signal analysis, with applications in seismic imaging and spectral decomposition. Computations such as synchrosqueezed wavelet transform and Empirical Mode Decomposition (EMD) address spectral leakage and nonstationary signals. Inverse-space seismic processing arranges forward data matrices for improved handling of dominant multiple scattering.

Reflection seismology, a cornerstone in geophysical exploration, relies on deconvolution to remove the source wavelet and recover seismic reflectivity. Challenges like wavelet band-limitation and Sparse Spike Deconvolution (SSD) are addressed using Toeplitz matrices for wavelet-sparse reflectivity modeling and parabolic Radon transforms for noise elimination. Advanced methods such as Gray-Level Co-Occurrence Matrix (GLCM) texture analysis improve the delineation of subsurface features.

Finally, seismic attributes, machine learning, and matrix arithmetic contribute to enhanced imaging, interpretation, and inversion processes. Tools such as LAPACK and BLAS facilitate efficient matrix operations in this context.

Keywords: Parallel computing; Matrices; Wavelet transform; Seismic data processing

ICMA 18: Statistical Inferences for the Generalized Rayleigh Distribution Under an Adaptive Progressive First-Failure Censoring Scheme

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Abstract: Reducing experimentation time and expense without sacrificing the efficiency of statistical estimation is the major goal of survival and reliability research. A censoring strategy that maintains the estimators' efficiency while substantially reducing the expected duration to complete an experiment is proposed. The proposed scheme generalizes several censoring methods that are currently in existence. Maximum likelihood estimators, asymptotic confidence intervals, and bias-corrected bootstrap confidence intervals for the generalized Rayleigh distribution's parameters are obtained under the proposed censoring scheme.

In order to determine whether or not the censored sample is drawn from a particular distribution, an approximate goodness-of-fit test is developed. The expression of the expected experimentation time is obtained for the proposed censoring strategy. Furthermore, various point predictors and prediction interval techniques have been explored to predict the failure times of the censored units. The efficiency of the estimators and the behaviour of the expected experimentation time under the proposed censoring is assessed using a Monte-Carlo simulation and compared with some existing censoring schemes. Additionally, a power analysis is carried out for the proposed goodness-of-fit test. Lastly, the applicability of the suggested censoring strategy has been demonstrated using a reliability data set.

Keywords: Generalized Rayleigh distribution; Adaptive progressive first-failure censoring; Goodness-of-fit test; Expected experimentation time; Classical prediction

ICMA 19: Robust Bayesian Estimation of Transition Probabilities of an Extended Illness-Death Model

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Abstract: Prior selection in the Bayesian paradigm is a critical step that influences the resulting inferences and predictions. It contains the essence of prior knowledge or beliefs about the parameters before observing the data. In cases where we have little or no information on the parameters, it is advised to choose a prior that has the least impact on the final outcome of the analysis. One way to choose such a prior is by considering the ϵ-contamination class of priors and selecting a prior from it in a data-dependent fashion.

In this paper, for the analysis of the extended illness-death model, the Weibull hazard rate function is used as the transition hazard rate. The transition probability is a crucial determinant in any multistate model, providing the chance of an individual being observed in a particular state under given circumstances.

We discuss the elicitation of the ϵ-contamination class of priors and give the Bayes estimates of transition probabilities. We utilise the Metropolis-adjusted Langevin algorithm for computation. Numerical illustrations have been given using simulated and real data sets.

Keywords: Bayesian estimation; Multi-state model; Weibull hazard rate function; Transition probability; Metropolis-adjusted Langevin algorithm

ICMA 20: The Haar Wavelet Analysis of Free Axisymmetric Vibration of Elastically Restrained FG Annular Plate Resting on Foundation

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Abstract: Free axisymmetric vibration analysis of a thin functionally graded elastically restrained annular plate is studied here. The plate is resting on a variable foundation, and the mathematical model is developed using the classical plate theory. The mechanical properties of the plate material are supposed to vary exponentially in the thickness-radial plane. The mathematical model is solved using the Haar wavelets. The effects of the material property gradient index, restraint parameters, and foundation parameter on the first three frequencies are studied. The present analysis is validated by a convergence study. Accuracy and reliability of the Haar wavelets are shown by comparing frequencies with those available in the literature for classical boundary conditions with/without foundation.

Keywords: Haar wavelets; Free axisymmetric vibration analysis; Annular plate; foundation

ICMA 21: On the Estimation of Two-Parameter Inverted Kappa Distribution: Characterizations and its Application to Lifetime Data

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Abstract: Recent advancements in space physics and statistical mechanics have highlighted the extensive use of the two-parameter Kappa distribution (KAP) for characterizing phase-space distribution functions. This paper introduces the

Inverted Kappa distribution, an extension of the two-parameter Kappa distribution, achieved by inverting the baseline random variable. Key statistical properties, such as inverse moments, reliability functions, hazard functions, and quantile functions, are thoroughly derived. Parameter estimation is explored from both classical and Bayesian perspectives using censored samples, and Monte Carlo simulations are employed to validate estimator performance for different variations of censoring parameters. The practical relevance of the Inverted Kappa distribution is demonstrated through the analysis of real-life reliability and survival data. This new distribution significantly advances statistical modelling, offering robust analytical capabilities and practical applications across various fields.

Keywords: Kappa distribution; Inverse Kappa distribution; Inverse moments; Survival characteristics; Progressive first failure censoring scheme; Bayes estimation

ICMA 22: Quantum Continuity Equation: Implication for Bohmian Mechanics

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Abstract: Despite a good mathematical formalism, we present a view that the interpretation of quantum mechanics lacks unanimous approval among physicists. To show its inadequacy, I describe the well-known measurement problem and discuss two solutions: an orthodox solution and hidden variable. I go into good detail describing hidden variable, also known as Bohmian mechanics. I derive the quantum continuity equation and show that a realist interpretation of the quantum probability current $\vec{j}$ leads to the guiding equation for Bohmian mechanics. Albeit Sakurai and Napolitano caution against a literal interpretation of $\vec{J}$ due to its apparent violation of the uncertainty principle, we address this concern by providing Romano's response.

Keywords: Quantum continuity equation; Quantum probability current; Guiding equation

ICMA 23: Graphs with Respect to Essential Ideals and Superfluous Ideals of Module Over a Nearrings

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Abstract: Nearrings are generalized rings. We consider modules over a right nearring. The notions such as essential submodule and its dual notion superfluous submodule are well-known in modules over rings. In this talk, we introduce the notions of essential ideal graph and superfluous ideal graph of a module over a nearring and prove some combinatorial properties involving diameter, connectivity, completeness, etc., with some illustrations.

Keywords: Nearring; Module over a nearring

ICMA 24: Weak Hypervector Spaces over Hyperfield

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Abstract: Hypervector spaces over a hyperfield are the generalized vector spaces in which at least one operation is taken as a hyperoperation. In this talk, we provide some interesting examples and counterexamples that highlight the importance of weak hypervector spaces. Furthermore, we establish the properties of subhyperspaces and isomorphism theorems between hypervector spaces. Finally, we explore the structural aspects of weak hypervector spaces, particularly in the case of dual spaces.

Keywords: Hypervector spaces, Subhyperspaces, Linear transformations; Direct sum; Dual space

ICMA 25: Transmission Dynamics of Meningitis to Determine the Significance Impact of Vaccination, Negative Effect of Carrier and Control on Children under 15 Years in the North Western Nigeria

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Abstract: The model describes meningitis transmission, designed into compartments which leads to a linear system of differential equations. The model used 2017 data on meningitis outbreaks in children in northwestern Nigeria. All Eigenvalues are found negative and R_0 (the threshold parameter) is greater than 1. Equilibrium points are found, and their stability based on a threshold value R_0 is investigated. The result based on the analysis shows that the significant impact of vaccination during an outbreak is negative or insignificant on meningitis transmission dynamics. Since R_0 is greater than 1, the endemic equilibrium is stable both locally and globally.

Keywords: Meningitis; Carrier; Vaccination

ICMA 26: Hybrid Iterative Process for Solving Nonlinear Problems: An Application in Bratu and Delay Differential Equations

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Abstract: Our aim is to construct a new and novel iterative process which is a hybrid of the well-known Picard and Modified Mann iterative processes for solving nonlinear problems involving several operators. We obtain strong convergence of the process to the (unique) fixed point of contraction operators under suitable and satisfactory convergence conditions. Through computational illustrations, the results displayed in graphs and/or tables will further show that the process converges faster than many known iterative processes reviewed in the literature. Furthermore, stability analysis of the iterative process is conducted and shown. We make a general application of the new iterative process to solving Bratu and delay differential equations. It is also intended that the results obtained will improve and extend a significant number of results of authors found in the literature.

Keywords: Iterative process; Nonlinear problems; Fixed point; Operators; Strong convergence

ICMA 27: Newly Exploring the Lax Pair, Bilinear Form, Bilinear Bäcklund Transformation Through Binary Bell Polynomials, and Analytical Solutions for the (2 + 1)-Dimensional Generalized Hirota-Satsuma-Ito Equation

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Abstract: The (2 + 1) - dimensional generalized Hirota-Satsuma-Ito equation describing the numerous wave dynamics in shallow waters is investigated in this study. The integrable characteristics of the aforesaid equation, such as a bilinear Bäcklund transformation and Lax pair, are revealed using the Bell polynomials method. First, using this technique, with the aid of Hirota operators, the bilinear form is constructed for the considered equation. In addition, the bilinear Bäcklund transformation and the Lax pair of the aforesaid equation are derived successfully using the bilinear form. Moreover, the bilinear form is also used to construct analytical solutions utilizing the three-wave approach with a test function. While using this method, numerous analytical solutions are derived which are not presented in the literature. A three-dimensional graph has been plotted for each of the obtained results by giving the appropriate values of the free parameters. These plots reveal a wide variety of wave behavior, such as kink-soliton, periodic wave, anti-kink soliton, and complex periodic wave solutions.

Keywords: (2 + 1) - dimensional generalized Hirota-Satsuma-Ito equation; Bell polynomials; Bilinear Bäcklund transformation; Lax pair; Three-wave method

ICMA 28: Learning Opportunities for Solving Context-Based Calculus Tasks in Nepal's High School Mathematics Textbooks

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Abstract: Research shows that linking mathematics to real-world contexts can motivate students to learn mathematics and improve their performance in the subject. Improving students' ability to solve context-based problems has become even more important recently due to the rapidly changing nature of the professional world. The extent to which students achieve intended learning outcomes depends largely on the opportunity-to-learn (OTL) the assessed concepts and skills offered in the textbooks. However, various reports show that Nepali students struggle to solve context-based problems. Using Wijaya et al., (2015), we conducted a content analysis of the commonly adopted Nepali mathematics textbooks for grades XI and XII to assess the OTL they afford for tackling context-related problems in calculus. Results show that almost all mathematical concepts were introduced without providing related contexts, and around 95% of worked examples and exercise problems did not have any context and offered little or no opportunities for modeling and mathematization. Although most of the contexts presented in the problems were meaningful, the cognitive demands

of many of those tasks were lower. The investigated textbooks were not necessarily aligned with Nepal's updated National Mathematics Curriculum (2018), which underscores the integration of mathematics with real-world applications. Results of this study indicate that the limited OTL to solve context-based tasks in Nepali mathematics textbooks might be one of the reasons for students' poor performance in solving such tasks.

Keywords: Context-based tasks; Calculus; opportunity-to-learn; Content analysis of mathematics textbooks; Mathematics education in Nepal

ICMA 29: Mathematical Study of Heat Regulation in a Human Body with Dermal Tumor Having Malignancy

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Abstract: In this paper, we consider the case when the body is having a malignant tumor located in the outer peripheral region. As we know, the malignant part of the body enhances heat generation due to cell division and attracts micro blood vessels for extra oxygen supply. Such an increase in the capillary network and an increase in the demand for blood in excess of the capacity of the host arterioles would result in a decline in arteriolar pressure. At the same time, extra vascular pressure in the tumor increases as a proliferation of tumor cells within a limited space. An increase in the extravascular pressure exceeding the arteriolar pressure results in regional vascular stasis and necrosis. The limitation of diffusion length of oxygen and possibly other nutrients is believed to be another cause of necrosis in the tumors. The distribution of blood perfusion in the tumors is quite heterogeneous. We construct a mathematical model of the above in terms of differential equations. We transform the equations to variational form and solve it numerically.

Keywords: Malignant tumor; Differential equations; Finite element method; Numerical computation

ICMA 30: Semitotal Roman Dominating Function in Graphs

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Abstract: Let G be a nontrivial connected graph. A function $f : V(G) \to \{0, 1, 2\}$ is a semitotal Roman dominating function of G if it satisfies the following conditions:
(S1) For every $v \in V(G)$ with $f(v) = 0$, there exists $u \in N_G(v)$ such that $f(u) = 2$; and
(S2) For every $u \in S$ where $S = \{u : f(u) = 0\}$, there exists $w \in S$ such that $d_G(uw) \geq 2$.
The minimum weight $t_2^R(G) = \sum_{u \in V(G)} f(u)$ of a semitotal Roman dominating function f of G is the semitotal Roman domination number of G, denoted by $t_2^R(G)$. This paper initiates the study of semitotal Roman dominating functions in graphs. It determines the specific values of $t_2^R(G)$ for some special graphs and characterizes graphs G with small values of $t_2^R(G)$. Additionally, it establishes relationships between this concept and other existing related concepts. Furthermore, this paper investigates the semitotal Roman dominating functions in some graphs resulting from binary operations, and as a consequence, determines their corresponding semitotal Roman domination numbers.

Keywords: Semitotal Roman dominating function; Semitotal Roman domination number; Graph theory; Binary operations; Domination functions

ICMA 31: Recent Developments on the Non-Inner Automorphism Conjecture of Finite p-Groups

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Abstract: A well-known conjecture posits that every finite non-abelian p-group possesses a non-inner automorphism of order p. In this paper, we present a comprehensive overview of the most recent developments related to the non-inner automorphism conjecture.

Keywords: Non-inner automorphisms; p-groups

ICMA 32: Addressing Non-Response and Measurement-Errors in Population Mean Estimation Using Memory Exponential Type Estimators

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Abstract: In this study, we employ the Exponentially Weighted Moving Average (EWMA) statistic to develop a generalized estimator aimed at improving the estimation of population means. We also investigate the impact of measurement errors and non-responses on the accuracy of population mean estimation for different cases. Additionally, we derive expressions for the Bias and Mean Square Error (MSE) of the proposed estimator, up to the first order of approximation, and compare it with several existing estimators. Furthermore, we conduct extensive simulation studies and assess the performance of the proposed estimator, finding that it exhibits superior efficiency compared to existing estimators.

Keywords: Auxiliary variable; Memory type estimator; Measurement error; Non-response; Simulation

ICMA 33: On Permutation Identities and Commutativity in Nearrings

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Abstract: We study permutation identities satisfied by weak semigroup left ideals in near-rings. We obtain a result on the commutativity of a 3-prime nearring using a weak semigroup left ideal satisfying a permutation identity, where the permutation does not fix 1.

Keywords: Nearring; 3-prime, Permutation identity

ICMA 34: Wave Propagation in Micromorphic SH Waves in Contact

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Abstract: In this paper, an attempt is made to study the propagation of SH waves in two micromorphic half spaces in contact. The period equation is obtained. It is observed that three additional waves are found which are not encountered in classical elasticity.

Keywords: SH waves; Micromorphic; Wave propagation; Classical elasticity

ICMA 35: Can WhatsApp Improve the Academic Performance? A Statistical Analysis

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Abstract: There has been an unending debate about the effect of WhatsApp on students' performance globally. This paper seeks to contribute to this debate by investigating the extent of WhatsApp usage and its effect on Uttarakhand's post-graduate students' academic performances. Estimation tools such as simple descriptive statistics, the difference-in-difference method, and ordinary least square regression analyses were applied to a survey of 250 post-graduate students. At the top of the study, we found that most MBA students in India use WhatsApp during academic activities, connect with their professors via WhatsApp, and spend between 1 – 2 hours each day on WhatsApp. We also found a significant difference between the GPAs of students who are connected with their professors and those who are not connected with their professors. Again, we found a low level of addiction to WhatsApp but severe threats to circulating and withholding information by post-graduate students. It was also discovered that student connection with the professors via WhatsApp and spending 3 – 5 hours on WhatsApp increases academic performance. Therefore, we recommend that school management put policies that will promote a positive and healthy relationship between professors and students, primarily via WhatsApp. The Indian Ministry of Information should enact laws that frown on sending false information on social media with possible punishment. Finally, we recommend that school management institutions have strict policies to prevent students from using WhatsApp during academic activity.

Keywords: Academic performance; Education; Management; Student; WhatsApp

ICMA 36: An Overview of El Dika's Proof of Asymptotic Stability of Solitary Waves for the BBM Equation

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Abstract: In this presentation, I will introduce the Benjamin-Bona-Mahony (BBM) equation and its solitary wave solutions and discuss the concepts of orbital stability and asymptotic stability of the solitary wave solutions. I will then provide an overview of El Dika's proof of asymptotic stability based on a monotonicity property of the equation and a Liouville-type theorem.

Keywords: BBM equation; Solitary wave solutions; Asymptotic stability; Monotonicity property; Liouville-type theorem

ICMA 37: Modeling of Transmission Dynamics of Dengue Infection in Kathmandu Valley, Nepal: Impact of Inadequate Waste Management

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Abstract: Dengue fever has become a significant public health issue in Nepal, with its incidence and prevalence rising over the years. Mathematical models provide valuable insights into dengue transmission dynamics and help assess the potential impact of various interventions. In this presentation, we will discuss a mathematical model that incorporates solid waste-driven factors to describe the spread of dengue in Kathmandu Valley during 2022, the year of the largest outbreak in Nepal's history. Our model is fitted to dengue cases from 2022 in the Valley, allowing for a more accurate representation of the disease spread. The major component in the model is the solid waste-driven factor, recognized as a significant factor in mosquito breeding and the spread of dengue in the Kathmandu Valley. By evaluating the effect of this factor, we assess the role of inadequate waste management in the proliferation of dengue in Kathmandu Valley, Nepal.

Keywords: Dengue fever; Transmission; Solid waste; Modeling

ICMA 38: On the Existence and Asymptotic Behavior of Solutions of a Class of Reaction-Diffusion Systems with Exponential Growth Reaction

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Abstract: In this work, we develop the exponent of exponential growth for which the global existence in time of a diagonal system with exponential growth is studied. The idea is to simplify the proof of a theorem in the triangular case. This demonstration is based on techniques involving functionals (called Lyapunov) with the aim of obtaining a priori estimates on the second component of the unique solution of the system in question and in order to be able to apply the principle of the effect regularizing. We were able to double the current length of the interval to which the exponent of the exponential growth of the reaction belongs. Finally, we exploited the functional, which gave the global existence in time of the solutions, to determine their asymptotic behavior. More precisely,

it was shown that the solutions tend towards well-calculated constants based on the initial data and the reaction.

Keywords: Parabolic systems; Reaction-diffusion; Global existence; Lyapunov functional; Asymptotic behavior

ICMA 39: A Polynomial-Time Algorithm for Constructing Nondecreasing Integer Partitions and Its Application

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Abstract: Let n be a nonnegative integer and P_n be the number of distinct unrestricted partitions of n. The fastest algorithm proposed until today for constructing all the unrestricted partitions of n was shown to run in time $O(nP_n)$. Since P_n increases exponentially as n increases, finding an algorithm for constructing these partitions of n in polynomial time is still an open problem. Here, we consider the unrestricted partitions of n as the nondecreasing integer sequences and give an efficient recursive method to construct all these nondecreasing partitions of n. We show that the algorithm for constructing these nondecreasing partitions of n runs in polynomial time with complexity $O(n^2)$. We apply this notion of nondecreasing integer partitions in the enumerations of some classes of unlabeled posets according to the number of their connected components. Since the direct sum of posets is commutative, the pairwise nonisomorphism of the disconnected posets depends on a nondecreasing sequence of the cardinalities of their direct terms. We show that any two disconnected posets of the same cardinality n are isomorphic if and only if the cardinalities of their direct terms constitute the same nondecreasing integer partition of n. These results allow us to implement the enumeration algorithm into the computer and to obtain the numerical data giving the exact enumerations of some classes of unlabeled disconnected posets.

Keywords: Unrestricted integer partitions; Polynomial-time algorithm; Disconnected posets; Exact enumeration

ICMA 40: Need for Robust Numerical Methods

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Abstract: Mathematicians are seriously concentrating on developing robust numerical methods for solving the most challenging problems like Boundary Layer Problems. The region in which the solution changes rapidly is called the Boundary Layer. In fact, the solution changes rapidly to satisfy the given conditions of the problem. Any ordinary differential equation in which the highest order derivative is multiplied by a small parameter always exhibits the boundary layer phenomenon. Solving these problems is very difficult due to the boundary layer phenomenon. If we use the existing numerical methods with the step size more than the parameters, we get oscillatory solutions due to the presence of the boundary layer. Existing numerical methods will produce good results only when we take the step size less than the parameters. This is a very costly and time-consuming process. Hence, the researchers are concentrating on developing robust numerical methods, which can work with a reasonable step size. In fact, these robust numerical methods should be independent of the parameters. The efficiency of such numerical methods is determined by its accuracy, simplicity in computing the solution, and its sensitivity to the parameters of the given problem. With this motivation, we present here some simple, easy, and efficient robust numerical methods that are readily adaptable for computer implementation with a modest amount of problem preparation. Several model linear and non-linear model examples are solved to demonstrate the applicability of these methods. The solutions are compared with exact solutions. It is observed that our methods approximate the exact solution very well.

Keywords: Boundary layer problems; Robust numerical methods; Efficiency; Linear and non-linear models

ICMA 41: Global BMO Estimates for Non-Newtonian Fluids with Perfect Slip Boundary Conditions

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Abstract: We study the generalized stationary Stokes system in a bounded domain in the plane equipped with perfect slip boundary conditions. We show natural stability results in oscillatory spaces, i.e., Hölder spaces and Campanato spaces including the border-line spaces of bounded mean oscillations (BMO) and vanishing mean oscillations (VMO). In particular, we show that under appropriate assumptions, gradients of solutions are globally continuous. Since the stress tensor is assumed to be governed by a general Orlicz function, our theory includes various cases of (possibly degenerate) shear thickening and shear thinning fluids, including the case of power law fluids.

Keywords: Stokes problem; Hölder regularity; Perfect slip

ICMA 42: SDDS-SABC Optimization: A Novel Approach For Solving Complex Real-World Engineering Design Problems

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Abstract: Practical limitations in real-world engineering design optimization restrict the effectiveness of traditional methods. While many advanced techniques have emerged, a universally effective solution remains elusive. To address this, we introduce a novel hybrid optimization approach, integrating branch-and-bound-like interval analysis with heuristics. Our method, called SDDS-SABC, combines the Split-Detect-Discard-Shrink (SDDS) technique with a Sophisticated ABC algorithm (SABC). SDDS reduces the search space by focusing on promising subregions, while SABC efficiently identifies optimal solutions within these areas. This process is repeated until a global or near-global solution is achieved. Key innovations include using Latin hypercube sampling for improved initialization and a dual-strategy employed bees phase for enhanced neighborhood exploration. Additionally, a new dynamic penalty method eliminates the need for extra parameters. Our method is applied to 57 complex real-world benchmark problems (CEC2020) across various fields, including industrial processes, mechanical engineering, and power systems. Statistical tests (Friedman and Wilcoxon rank) comparing SDDS-SABC to three established algorithms show superior performance, demonstrating its effectiveness and stability in solving complex optimization problems. The novelty lies in its ability to consistently find near-optimal solutions for highly complex problems.

Keywords: Constrained optimization; Global optimization; ABC algorithm Heuristic; Penalty function

ICMA 43: Application of Lex-Max Flow Problem in Vertex Restricted 1-Center Problem with Fixed Demands at Prioritized Vertices

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Abstract: The lexicographically maximum flow (Lex-Max Flow) problem aims to maximize the flow values at prioritized and capacitated vertices of a given network. This type of problem can be applied to real-world scenarios, such as the emergency evacuation problem. In this paper, we consider the 1-center problem, which involves locating a center within a given region to fulfill demands at

prioritized vertices as quickly as possible. We explore the problem from two perspectives: facility location and evacuation center. We propose polynomial-time solution algorithms based on the Lex-Max Flow algorithm for both problems in a Uniform Path Length (UPL) network, a restricted class of networks.

Keywords: Uniform path length network; Center problem; Lexicographically quickest flows; Facility location; Evacuation planning

ICMA 44: Solving Reaction Diffusion Equation Using Transformer Based Koopman Autoencoder

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Abstract: A transformer-based Koopman autoencoder is proposed for linearizing the reaction-diffusion equation. The primary focus of this study is on using deep learning techniques to find complex spatiotemporal patterns in the reaction-diffusion system. The emphasis is not just on solving the equation but also on transforming the system dynamics into a more comprehensible, linear form. Global coordinate transformations are achieved through the autoencoder, which learns to capture the underlying dynamics by training on a dataset with 60,000 initial conditions. Extensive testing on multiple datasets was used to assess the efficacy of the proposed model, demonstrating its ability to accurately predict the system evolution as well as to generalize. We provide a thorough comparison study, comparing our suggested design to a few other comparable methods using experiments on various PDEs. Results show improved accuracy, highlighting the capabilities of the Transformer-based Koopman autoencoder. The proposed architecture is significantly ahead of other architectures in terms of solving different types of PDEs using a single architecture. Our method relies entirely on the data, without requiring any knowledge of the underlying equations. This makes it applicable even to datasets where the governing equations are not known.

Keywords: Reaction-diffusion Equation; Transformers; Autoencoders

ICMA 45: A Parameter Uniform Domain Decomposition Method for Singularly Perturbed Semilinear Coupled System

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Abstract: This work analyzes a semilinear coupled system of singularly perturbed parabolic problems where different magnitude parameters are multiplied by the diffusion term. An overlapping domain decomposition algorithm is proposed to solve this system numerically. On each subdomain, a classical central difference scheme in space and an Euler scheme, along with the splitting of components technique in time, are employed. In this manner, the numerical solution is computed by decoupling the elements of the solution, which results in a significantly lower computational cost for the method than for the classical method. We introduce an iterative process to solve the semilinear coupled system where the Dirichlet boundaries are used to exchange information between the subdomains. The algorithm is proved to be parameter uniform. To support the theoretical findings, we have included two test problems. Moreover, to show the efficiency of the proposed methods, we compare the CPU time (in seconds) for the proposed methods with the classical Euler method.

Keywords: Semilinear parabolic systems; Schwarz waveform relaxation; Domain decomposition method; Additive schemes

ICMA 46: Analysis of Hemodynamic Parameters on Two-layered Blood Flow in an Artery with Mild Stenosis

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Abstract: Arterial stenosis is the thickening of the arterial wall due to the growth of aberrant tissues that prevent adequate blood flow in the human circulatory system and induces cardiovascular diseases. Mild stenosis may lead to serious or permanent damage if remains uncured. There are differences in the material composition between the outer layers and the core. The Navier-Stokes equation in the cylindrical polar coordinate system has been extended in two-layered blood flow along the axial direction with appropriate boundary conditions. Mathematical expressions for hemodynamic parameters such as velocity profile, volumetric flow rate, pressure drop, and shear stress have been calculated analytically in the case of stenosed artery. Moreover, we have analyzed the effect of stenosis on different hemodynamic parameters with the variation of core and peripheral-layer viscosity. Flow quantities are affected by the habitancy of stenosis and stipulate different blood flow behavior in both layers. This modeling technique may help researchers in the field of medicine, mathematical biology, and bio-engineering.

Keywords: Arterial stenosis; Velocity profile; Volumetric flow rate; Pressure drop; Shear stress.

ICMA 47: Solutions of Two Dimensional Contaminant Transport in Turbulence Atmospheric Model

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Abstract: This paper presents a model that explains the movement of contaminants through the atmosphere, influenced by advection, diffusion, and turbulence in both the x and y directions. The purpose of this mathematical model is to incorporate data into the governing equations, allowing simulations to produce a reliable approximation of the phenomenon. The exact solution of this model is typically unavailable. So, it is essential to numerically approximate the solution to assess the prediction from the associated mathematical model. The numerical solutions of this model are obtained from the Crank-Nicholson and alternating direction methods by appropriately discretizing the domain. In this study, the numerical solutions and their effectiveness are compared with the exact solution, which is obtained using a Gaussian pulse as the initial condition and coordinates transformation, through the 3D plots and the rigorous analysis.

Keywords: Advection, Diffusion, Turbulence, Eddy diffusivity, Air pollution, Analytical solution, Numerical solution

ICMA 48: Numerical Solution of Advection Diffusion Equation by Using Fractional Bernstein Polynomial

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Abstract: We introduce a simple and efficient method to solve fractional integro-differential advection-diffusion equations with Caputo derivatives. The technique uses fractional Bernstein polynomials to handle the complexity of these equations. Using Bernstein polynomial operational matrices, the proposed method simplifies numerical computation by converting fractional differential equations into algebraic systems. Numerical examples show that the approach works well, and accurately solves fractional integro-differential advection-diffusion problems. We show that the fractional Bernstein polynomial method is both accurate and efficient in terms of computation. The ability of the fractional Bernstein polynomial to model nonlocal effects and anomalous diffusion in physical processes suggests significant applications across a wide range of mathematical and physical research fields.

Keywords: Fractional Bernstein polynomials; Integro-differential equations; Caputo derivatives; Advection-diffusion equations; Numerical methods

ICMA 49: Quadruple Fixed Points Results in Bipolar Metric Spaces

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Abstract: In this paper, we establish the existence and uniqueness of common quadruple fixed point results for integral-type contraction in complete bipolar metric spaces. We examine the existence of a unique solution to an initial value problem and study the existence of a unique solution to homotopy theory.

Keywords: Bipolar metric space; Compatible mappings; Integral type contraction; Completeness; Common quadruple fixed point

ICMA 50: Ideals and Fuzzy Ideals in Heyting Algebras

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Abstract: In this paper, we introduce a notion of ideals and fuzzy ideals in Heyting algebras. We give some properties and characterizations of ideals and fuzzy ideals in Heyting algebras.

Keywords: Heyting algebra; Ideal; Fuzzy ideal

ICMA 51: Zero Knowledge Proof in Digital Currency Security

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Abstract: In recent years, a noteworthy trend in the financial world has been the remarkable rise in the popularity of digital currencies. Nepal Rastra Bank (NRB) revealed in August 2022 its intentions to develop a central bank digital currency (CBDC). Essentially, it's like having digital cash in your pocket—only safer, more efficient, and traceable. According to a 2022 report by the Bank for International Settlements, over 60% of central banks worldwide are either exploring or actively developing CBDCs, highlighting the global shift towards digital currencies.

Blockchain technology records and confirms digital currency trades, like a digital ledger. Blockchain allows a person to safely send money to another person without going through a bank or financial services provider. It collects and stores information about buying, selling, or exchanging digital assets. This information exists without a central authority (such as a bank) overseeing or controlling the digital currency market. Blockchain is a method of recording information that makes it impossible or difficult for the system to be changed, hacked, or manipulated. Satoshi Nakamoto developed a protocol for a peer-to-peer electronic cash system that became the foundation for distributed ledgers called blockchains.

Zero knowledge proofs (ZKPs) are cryptographic methods that allow one party (the prover) to prove to another party (the verifier) that a certain statement is true without revealing any information beyond the validity of the statement itself. In blockchain transactions, ZKPs allow the validation of transactions without exposing sensitive details. Deploying ZKPs cryptography could allow for trustless privacy in CBDC. To achieve cash-imitating levels of privacy, transaction details can be kept confidential between the sender and receiver using ZKPs technology.

In this paper, I briefly introduce zero knowledge proof (ZKPs) cryptography, a backbone security of blockchain technology and their use in central bank digital currency (CBDC).

Keywords: Zero knowledge proof; CBDC; Blockchain technology; Cryptocurrency

ICMA 52: Lattice of Stone Ideals and *-Filters of a PJP-Semilattice

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Abstract: In this paper, we introduce a new notion of Stone ideals in PJP-semilattices and give some characterizations of it. We also study the class of *-filters in PJP-semilattices. We show that the class of *-filters forms a Boolean lattice. We also prove that the class of *-filters of a PJP-semilattice is equivalent to the class of Stone ideals of the PJP-semilattice.

Keywords: PJP-semilattice; Boolean lattice; Stone ideal; *-filter

ICMA 53: Analysis of Longitudinal Vibrations in a Micropolar Micro-Stretch Elastic Cylinder Under the Effect of Surface Stress

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Abstract: The purpose of this article is to calculate the longitudinal vibrations in a homogeneous, isotropic, micropolar, micro-stretch elastic cylinder. Cylindrical coordinates are used to represent the constitutive relations and equations of motion. The dispersion relations relating to longitudinal vibrations under the influence of surface stress in a micropolar micro-stretch elastic cylinder are determined analytically using the method of plane harmonic solution. As a specific example, the dispersion relations of these vibrations in a non-stressed solid were also calculated. Under the implementation of MATLAB software, the impact of surface stress on the frequency of longitudinal vibrations for a certain material with a non-uniform radius is graphically displayed.

Keywords: Longitudinal vibrations; Micropolarity; Micro-stretch; Elastic cylinder; Surface stress

ICMA 54: Convective Heat Transfer from a Highly Porous Obstacle Affixed to the Wall of a Rectangular Channel to Air at Low Reynolds Numbers

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Abstract: The study investigates momentum and heat transfer from a semicircular porous block affixed to the lower wall of a channel, with air as the working fluid. Porous obstacles within flow channels introduce resistance to

fluid movement and substantially impact heat transfer. These obstacles are commonly encountered in pipeline fouling, heat exchanger tubes, blood clotting in blood vessels, stenosed arteries, etc. The fluid enters the channel at a uniform velocity and temperature, while the porous block's surface is kept at a constant temperature. No-slip and thermal insulation boundary conditions are applied to the channel walls. Key parameters governing the flow and heat transfer include the Reynolds number ($0.01 \leq \mathrm{Re} \leq 40$), Darcy number ($10^{-6} \leq \mathrm{Da} \leq 10^{-1}$), porosity ($\epsilon = 0.9$), and blockage ratio ($\beta = 1.5$), defined as the ratio of the obstacle's radius to the channel height. The Darcy-Brinkman-Forchheimer model captures viscous and inertial effects within the porous block. Using COMSOL Multiphysics and the finite element method, the flow and thermal fields are visualized through streamlines and isotherm contours. The study assesses the combined effects of these parameters on pressure and drag coefficients and the Nusselt number. The obstacle behaves like a solid at the lowest Darcy number ($\mathrm{Da} = 10^{-6}$) and mimics unobstructed channel flow at the highest Darcy value ($\mathrm{Da} = 10^{-1}$). The drag coefficient increases with decreasing Da, while Da has a complex impact on the pressure coefficient. Both the Reynolds and Darcy numbers positively influence the Nusselt numbers.

Keywords: Convective heat transfer; Porous obstacle; Reynolds number; Darcy number; Nusselt number

ICMA 55: Analytical Schemes of Solitary Wave Solutions for Nonlinear PDEs Using the Novel (G'/G) Expansion Method

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Abstract: This paper presents analytical schemes for obtaining solitary wave solutions of nonlinear partial differential equations (PDEs) using the novel (G'/G) expansion method. Nonlinear PDEs play a significant role in modeling a wide range of complex phenomena in fields such as fluid dynamics, plasma physics, and optical fibers, where solitary waves are of particular interest. The novel (G'/G) expansion method offers a systematic and efficient approach to constructing exact solutions, including solitary wave solutions, for a broad class of nonlinear PDEs. In this study, we develop and apply analytical schemes based on the novel (G'/G) expansion method to derive new families of solitary wave solutions. These solutions include solitons, periodic waves, and kink-type structures, providing a comprehensive understanding of the nonlinear wave behavior. By transforming the original nonlinear PDEs into simpler algebraic equations, the method allows for the straightforward construction of explicit solutions. Several benchmark examples, including the Klein-Gordon equation and other nonlinear evolution equations, are explored to demonstrate the versatility and effectiveness of the proposed analytical schemes. The results confirm that the novel (G'/G)

expansion method is a powerful tool for finding solitary wave solutions to nonlinear PDEs. Its ability to generate a wide range of exact solutions with minimal computational effort makes it an attractive technique for researchers studying nonlinear wave phenomena in various scientific and engineering domains.

Keywords: Nonlinear partial differential equations; solitary wave solutions; novel (G'/G) expansion method

ICMA 56: Role of Magnetic Field on Blood Flow with Suspended Silver Nanoparticles Through Stenosed Artery

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Abstract: The present paper deals with the study of magnetic effects on silver nanoparticles suspended in the base fluid through an artery in the presence of overlapping stenosis. The study is carried out for a blood vessel under mild stenosis approximations. The governing equations are solved, and exact solutions are obtained for temperature, velocity, and resistance to flow. The effects of various parameters on the flow have been analyzed through graphs. The analysis also summarizes that silver nanoparticles are efficient in reducing hemodynamics of stenosis and could be helpful in biomedical applications. Results indicate that nanoparticles are beneficial as drug carriers to minimize the effects of resistance impedance to blood flow.

Keywords: Magnetic field; Overlapping stenosis; Nanoparticles

ICMA 57: Fixed Point Theorems in Fuzzy b-Metric Space with an Application to Fredholm Integral Equation

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Abstract: Fixed point theory is one of the most important techniques for proving the correctness of various mathematical models, such as ordinary and partial differential equations. One of the main pillars of fixed point theory since 1922 has been the extensively applied Banach fixed point theorem. Metric spaces are specific types of topological spaces that have attractive "geometric" characteristics. They are widely employed in both pure and applied mathematics

and have many attractive features. In 1965, Zadeh introduced the fuzzy set notion, which led to a new field of mathematical study. The aim of this study is to connect several well-known fixed point theorem results from fuzzy metric space to fuzzy b-metric space. We also apply these results to Fredholm integral equations.

Keywords: Fixed point; Fuzzy b-metric space; Convergent; Integral equation

ICMA 58: q²-Difference and Maliavin Calculation in the Modeling and Mathematical Analysis of Some Dermatoses: Case of Urticaria

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Abstract: The skin is the largest organ in the human body. A skin pathology can progress from the epidermis to the dermis, referred to as spongiotic diseases. Conversely, when the pathology progresses from the dermis to the epidermis, it is referred to as psoriasiforms. There are many forms of spongiotic and psoriasiform diseases, but generally speaking, a skin infection progresses from a more concentrated area to another less concentrated one. Consider $(x_i)_{i=1}^n$, n distinct blood vessels, with $S_1(x_i)$ as the pathological skin surface and $S_2(x_i)$ as the pathological subcutaneous surface. The governing equations are given by:

$$(Pb1) - \Delta S_1(x_i) = S_2(x_i), \quad x_i \in \Gamma_i$$

where Γ_i is the volume of the i-th blood vessel, assumed to be cylindrical with diameter d_i, and $\Gamma_i \subset [0, \infty[$. Due to the non-linear complexity of certain parts of the human body, such as the knee, elbows, wrists, and massive subcutaneous parts (fat stock), the diffusion of the pathogenic surface is slow and non-linear. The second equation is:

$$(Pb2) - \Delta_c S_1(x_i) + \mathrm{div}(S_1(x_i)) = S_2(x_i), \quad x_i \in \Gamma_i, \quad c \in [0, 1]$$

This work seeks to model the inverse problem, i.e., the evolution of the subcutaneous surface S_2, under the constraint that the system formed by problems (1) and (3) admits an exact or approximated solution. The formulation is based on Maliavin's calculations, introducing the hazard (probability of occurrence of urticaria) into the qualitative analysis of the trained system.

Keywords: q^2-difference, Maliavin calculation; Mathematical modeling; Mathematical analysis

ICMA 59: A Case Study on Evacuation Mitigation of Tinau Flood Victims

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Abstract: The Tinau flood is a devastating disaster in Butwal, a densely populated city in Western Nepal, threatening lives and properties. Evacuation planning is crucial to saving lives and minimizing the loss of properties. Literature has flourished with different mathematical models for evacuation planning. Network flow models are also applied to various real-world situations, including evacuation planning. This paper applies the Lex-Max contraflow network model for Tinau flood evacuation. In particular, we provide efficient evacuation plans considering different time durations for the data set of the evacuation region.

Keywords: Network flows, Contraflow; Lexicographically maximum flow problem; Multi-networks; Tinau flood

ICMA 60: Contraction Mappings in Probabilistic Metric Space

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Abstract: In 1906, French mathematician Maurice Frechet [3] systematically used abstract spaces to introduce the concept of distance axiomatically, called metric space. Nowadays, it has more than twenty generalizations. Menger space, a generalization of metric space, was introduced by Karl Menger [5] in 1942. Banach contraction mapping has been generalized in many different ways. The two different generalized forms of contraction mappings in probabilistic metric space were formulated by V.M. Sehgal [6] in 1966 and by T. L. Hicks [4] in 1983. Since then many researchers have formed weaker contraction mappings and established fixed point theorems in Menger space [1-2]. Our main aim is to discuss contraction mappings in probabilistic metric space and also to show their interrelationship between contraction mappings.

Keywords: Probabilistic metric space; Contraction mappings; Sehgal contraction; Hicks contraction

ICMA 61: Graph Neural Network for a Family of Weather Data Imputation

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Abstract: A graph neural network (GNN) is a type of deep learning model designed to perform tasks on graph-structured data by iteratively passing and updating information between nodes through their edges, capturing both local and global graph features. Weather data consists of recorded atmospheric conditions such as temperature, humidity, and precipitation, and weather imputation involves estimating missing or incomplete data in these records to improve the accuracy of weather models and analyses. We propose a simple yet effective approach that combines graph embedding and independent features to reconstruct the full set of weather attributes. By leveraging historical weather data from multi-stations across diverse climate regions in Nepal, our method allows for the imputation of temperature and humidity data both for individual weather stations and across all stations over a given time period. Extensive testing and validation confirm the effectiveness of our approach, with performance evaluated using key metrics such as Mean Squared Error (MSE), Mean Absolute Error (MAE), and the coefficient of determination (R^2). Our approach provides a robust framework for reconstructing historical weather data across varying rates of missing data.

Keywords: Graph representation; Imputation; Graph neural networks; Graph embedding; Independent features

ICMA 62: Weaker Forms of Commuting Mappings in Fuzzy Metric Space

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Abstract: Fuzzy sets were proposed by Zadeh [4] as a mechanism to capture the ambiguity of everyday life and provided the foundation for the development of fuzzy mathematics in 1965. Kramosil and Michalek [3] introduced the notion of fuzzy metric space in 1975, by generalizing the concept of Frechet metric space [5]. George and Veeramani [1] modified the concept of fuzzy metric space with

the help of t-norm in 1994. Jungck [2] introduced the commuting mappings and established common fixed point theorems by using constructive procedures of sequence of iterations in 1976. Sessa [6] proposed weakly commuting mapping as a modified notion of Jungck in 1982 and extended a variety of fixed point theorems by substituting weakly commutativity for commutativity mappings. The objective of this presentation is to discuss various non-commuting mappings in metric and fuzzy metric spaces and to update the comparative study on non-commuting maps, showing their interrelationship in metric and fuzzy metric spaces.

Keywords: Fuzzy metric space; Commuting mapping; Weakly commuting mapping; Compatible mappings

ICMA 63: Stability and Sensitivity Analysis of SEITR –SEI Model of Malaria Disease Transmission

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Abstract: Malaria is a vector-borne disease transmitted by the bite of female anopheles mosquitoes to humans. In our study, the SEITR-SEI compartmental model is used to describe the transmission dynamics of malaria, which includes a treatment compartment. The human population is divided into five compartments: Susceptible, Exposed, Infected, Under Treatment, and Recovered. For mosquitoes, the population is grouped into three compartments: Susceptible, Exposed, and Infected. The study focuses on analyzing the stability and sensitivity of the model with the help of the basic reproduction number (R_0) determined using the next-generation matrix method. Numerical simulations are presented to highlight the dynamics and interactions between these compartments.

Keywords: Malaria; Compartmental model; Basic reproduction number; Stability; Sensitivity analysis

ICMA 64: An Artificial Neural Network Approximation for Singularly Perturbed Differential Difference Equations

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Abstract: Singularly Perturbed Differential Difference Equations (SPDDEs) exhibit boundary layer behavior due to the presence of a small perturbation parameter, which poses challenges for traditional numerical methods. This paper presents a novel approach using a deep feed-forward Artificial Neural Network (ANN) to approximate the solution of SPDDEs without using exact solutions to train the network. The proposed ANN architecture, with single or double hidden layers, adjusts its hyperparameters during training to minimize the total loss function. The performance of the ANN is evaluated by comparing its results to both exact solutions and results available in existing literature. Numerical experiments demonstrate that the ANN method provides better approximations, outperforming traditional methods in several cases. This study highlights the effectiveness of ANNs as a mesh-free, adaptive tool for solving this class of differential equations.

Keywords: Neural networks; Activation function; Mixed shifts; Boundary layer

ICMA 65: Multi-Linear Variable Haar Multiplier

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Abstract: Dyadic harmonic analysis is vital in advancing modern harmonic analysis. Understanding the statements and proofs of complex continuous operators becomes simpler using dyadic operators and techniques. The Hilbert transform and Calderón-Zygmund operators are expressed as an average of appropriate dyadic operators to estimate these operators and prove the A_2 conjecture, which is central to the theory of weights.

We explore the Multi-Linear Variable Haar Multiplier $T_{\alpha w,\epsilon}$, derived from the t-Haar Multiplier $T_{tw,\epsilon}$, and its estimation in a multi-linear setting by introducing the Variable Square Function $S_{w,\epsilon}$.

Keywords: Dyadic operators; Calderón-Zygmund operators; Weight; A_2 conjecture; t-Haar multiplier

ICMA 66: Exponential B-spline Method for Differential Difference Equations Having Layer Behaviour with Negative Shift

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Abstract: This article presents an exponential B-spline method for the numerical treatment of a singularly perturbed differential equation with a negative shift that exhibits a boundary layer. By using Taylor's series expansion on the delay term, the equation is transformed into a singularly perturbed boundary value problem. The exponential B-spline method is then implemented to obtain a three-term recurrence relation. Finally, the invariant embedded algorithm is applied to approximate the solution of the equation, and convergence analysis of the method is discussed. The results are compared with existing literature, and it is shown that the method yields better results.

Keywords: Exponential B-spline; Negative shift; Invariant embedded algorithm; Tridiagonal system; Boundary layer

ICMA 67: Generalization of Contraction Mapping in Metric Space

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Abstract: The foundation of metric space fixed point theory is Stefan Banach's contraction mapping, a scholarly resource for reducing the distance between two points in space. As a source, numerous authors have developed many contraction mappings as extensions and generalizations of Banach contraction and established fixed point theorems under the property that each such mapping in complete metric and Menger spaces has a single fixed point.

In order to facilitate comparison and interrelationship studies in metric and Menger spaces, this article provides updated results on Banach contraction generalization and extension forms.

Keywords: Contraction mapping; Metric space; Menger space; Fixed point

ICMA 68: Determining the Solvability or Unsolvability of Modified Quadratic Diophantine Equations

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Abstract: We study the integer solutions to quadratic Diophantine equations of the form $x^2 - Dy^2 = N$, where D is a composite number that is not a perfect square, such as $D = 14$, and N is an odd integer. We explore the concept of quadratic residues and employ algebraic methods to determine the solvability or unsolvability of these quadratic Diophantine equations. Additionally, we use mathematical techniques such as the Euclidean algorithm, Bézout's identity, Thue's theorem, and the Chinese remainder theorem to derive results related to the solvability of modified quadratic Diophantine equations for various values of D and N. Furthermore, we identify a research gap in solving the equation $x^2 - 14y^2 = N$ for composite values of D and odd integer N.

Keywords: Determining Diophantine equation; Solvability; Identify

ICMA 69: An Enhanced Image Encryption Technique Using Chaotic Maps and Particle Swarm Optimization

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Abstract: As the world is becoming increasingly digitized, the protection of sensitive image data has become more important, owing to the rise of cyber crimes and invasion of privacy by unauthorized access. Conventional methods of encrypting data are often weak to provide adequate protection, hence the reason why there refer to the advanced mathematical methods. This paper explains a new method of image encryption which combines both chaotic maps and Particle Swarm Optimization (PSO) in three ways: confusion, diffusion, and optimization. In the confusion phase, the position of the pixels is confused using the Chen chaotic map thereby removing any spatial correlation due to pixel arrangement. In the next phase, diffusion, the pixel values are changed using the Logistic Tent map so that an image which is similar to the input image is encrypted, such that the input image without any change appears very different from the cipher image. The last step of the optimization phase is to apply the PSO algorithm to adjust the chaotic maps' parameters so as to produce the best possible cipher images. Our experiments showed great key sensitivity with the entropy values being close to 8, depicting a great level of randomness and efficient encryption. The method demonstrates strong immunity against known attack vectors and can be used in real-life scenarios. By ensuring a comprehensive approach towards the insertion of security measures in the transmission of sensitive images, the approach developed will greatly enhance secure communication, cloud computing, digital intelligence, geo-spatial interventions, and healthcare imaging.

Keywords: Image encryption; Chen chaotic map; Logistic Tent map; Particle Swarm Optimization

ICMA 70: Mathematical Study of the Transmission Dynamics of Lumpy Skin Disease in Karnali Province, Nepal

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Abstract: Lumpy skin disease (LSD) is a vector-borne disease caused by the lumpy skin disease virus (LSDV), which affects buffalo and mostly cattle. The disease was first reported in cattle farms of Morang district, Nepal in June 2020, and in 2023, a severe outbreak affected the whole nation with more than 52 thousand deaths and more than 15 million infected cases. Mathematical models provide useful insights into infectious disease transmission dynamics and can be used to assess the potential impact of various interventions.

This presentation will introduce a mathematical model of the LSD and its transmission dynamics in Karnali province, Nepal. Basic reproduction numbers and other key parameters will be estimated, validating real data.

Keywords: LSD; LSDV; Mathematical model; Basic reproduction number

ICMA 71: The Cause and Effect between the Attitude towards Mathematics of Master Business Students and Success in Business Studies in Pokhara Valley

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Abstract: The cause and effect between the attitudes towards mathematics of master business learners and success in business studies in Pokhara Valley is a pivotal part of knowledge for their academic successes. The objective of this study is to inquire about the self-confidence, value, motivation, and enjoyment of mathematics that play a vital role in success in business studies. This investigation examines the belief system of students on employed variables and observed variables. This study consists of 265 respondents of higher-level students related to business studies in Pokhara Valley from different universities and colleges. The researcher has prepared nine demographic and 31 structured questions based on dependent and independent variables, using a six-point Likert-type scale in the structured questions. Primary data was collected through field visits and analyzed. This study revealed that success in business studies is positively correlated to input variables such as self-confidence, value, motivation,

and enjoyment of mathematics. It further assessed that the value of mathematics and motivation of mathematics significantly affected success in commercial studies at the master's level. This study focused on the learners of MBA and MBS in Pokhara Valley.

Further studies on the cause and effect between the attitude towards mathematics of master business students and success in business studies across different colleges, times, and places should be completed separately to authenticate and generalize these consequences.

Keywords: Enjoyment; Mathematics; Motivation; Self-confidence; Success

ICMA 72: A Class of Cauchy Problem for the Poisson Equation from Steady-State Heat Conduction in Multilayer Media

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Abstract: In this paper, the Poisson equation mathematical model of two-dimensional steady-state heat conduction sideways problem in multilayer media is established. Due to the ill-posed characteristics of the Cauchy problem for the Poisson equation, some numerical methods for partial boundary condition inversion problem under different conditions are discussed. The Physics-Informed Neural Networks (PINNs) method is used for numerical experiments of the Cauchy problem. And various experiments analysis and numerical simulations are carried out. The results show that the PINNs method can effectively overcome the instability of inverse problems. The PINNs method for the inverse problem exhibits good noise resistance and high computational accuracy.

Keywords: Poisson equation; Cauchy problem; Heat conduction; Neural networks; Numerical simulation

ICMA 73: Separation Axiom on Intuitionistic Fuzzy Pairwise Topological Space Using Intuitionistic Fuzzy Open Sets

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Abstract: This study investigates the notions of intuitionistic fuzzy R_1 pairwise topological space and $\alpha - R_1$ type separation axioms on intuitionistic fuzzy bi-topological spaces in the sense of intuitionistic fuzzy open sets. We define four

notions of intuitionistic fuzzy R_1 pairwise topological space and three notions of $\alpha - R_1$ intuitionistic fuzzy bi-topological spaces and show the relationship among the notions separately with appropriate examples. In order to show the correctness of the proposed definitions, we show the good extension property for both types of the notions followed by examples as well. Finally, we show that our notions satisfy the hereditary and preserve the homeomorphism mapping properties.

Keywords: Intuitionistic fuzzy set; intuitionistic fuzzy bi-topological space; separation axiom; R_1 intuitionistic fuzzy pairwise topological space; Good extension

ICMA 74: Mathematical Modeling, Analysis, and Yogic Prevention of Infectious Disease Dynamics

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Abstract: Infectious diseases are major health problems that affect the whole economy. They have become the prime agenda of developed and developing countries. So, educating people about disease dynamics and preventive strategies is necessary. In this study, Yogachara has been introduced as a prevention strategy. Yogachara includes awareness such as Ahar, Vihar, Achar, and Vichar. They help maintain practitioners' physical fitness and improve the whole human body's metabolism system.

Our main objective is to model the disease dynamics with Yogachara as a prevention strategy. In this work, a modified form of the SIRS model incorporating a new disease transmission rate term $\beta_1 = \beta e^{-cM}$, where β is the disease transmission rate in the absence of Yogachara and M is the Yogashaka-infected mass, has been used. Real-life situation data were collected and analyzed using mathematical techniques. The yoga awareness reproduction number R_a was calculated using the next-generation matrix method. Stability analysis of the model system showed that the model is stable locally and globally.

Sensitivity analysis of R_a with respect to parameters indicates that R_a decreases with an increase in Yoga awareness coverage level. The recovery rate has an opposite relation with R_a, indicating that the recovery period also decreases with an increase in awareness coverage. Local and global stability analysis showed that disease-free equilibrium exists when $R_a < 1$ and endemic equilibrium exists when $R_a > 1$. Numerical simulations also support the analytical results and suggest that Yogachara positively influences preventing disease dynamics and reduces susceptibility and infectivity.

Keywords: Transmission dynamics; Yogachara; Awareness; Transmission rate; Endemic equilibrium

ICMA 75: Mathematical Analysis of the Fractional COVID-19 SEIR Model and the Impact of Fractional-Order Derivative

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Abstract: The fractional-order susceptible-exposed-infected-recovered (SEIR) model provides a comprehensive framework for simulating the dynamics of infectious disease transmission within a population. The inclusion of fractional-order derivatives offers more degrees of freedom than classical integer-order models in describing the complex dynamics of infectious diseases, aiding in a better understanding of disease spread and recovery strategies. In this study, we investigate the analytical approximate solutions of the SEIR model using the reliable homotopy perturbation method. The model is also examined through the fourth-order Runge-Kutta method, and the results are compared to the approximate analytical solutions to validate their accuracy and reliability.

To demonstrate the impact of the fractional-order derivative, we have computed results for different values of the fractional parameter α and found that the analytical solutions closely agree with the numerical results at $\alpha = 0.99$, underscoring the importance of fractional-order modeling. We discuss the real situation of coronavirus transmission under the influence of classical and fractional derivatives of α. The model provides insights into the dynamics of disease spread, assists in predicting the trajectory of a pandemic, and aids in assessing the impact of various public health interventions.

Keywords: Fractional SEIR model; Fractional-order effect; Homotopy perturbation method; Runge-Kutta fourth-order method

ICMA 76: The Numerical Method Based on Neural Network Method for a Class of Steady-State Heat Conduction Inverse Problems on Annular Domains

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Abstract: This paper employs a method based on Physics-Informed Neural Networks (PINNs) to solve steady-state heat conduction sideways problems on annular domains. The method transforms the sideways problem into an optimization control problem by embedding the Poisson equation and its boundary conditions into the neural network's loss function. The L-BFGS optimization algorithm is then used to minimize the loss function for numerical solutions. Numerical experiments demonstrate that the PINNs method effectively solves such problems, showing superior stability, accuracy, and noise resistance.

Keywords: Physics-informed neural networks; steady-state heat conduction; Sideways value problem; Numerical methods

ICMA 77: Magnetohydrodynamic Transient Natural Convection in Hybrid Nanofluid Filled Porous Wavy Cavity Containing Solid Obstacle

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Abstract: The fluid flow and heat transfer characteristics are numerically examined for transient natural convection in a hybrid nanofluid-filled porous wavy cavity containing a solid obstacle under the effect of a magnetic field. The cavity is heated from the bottom wall and cooled from the top wall. A circular solid cylinder is located at the centerline of the wavy cavity. The finite element method is used to simulate the governing equations, and the response surface method is also employed to perform statistical analysis and sensitivity studies. Obtained numerical results are presented graphically in terms of streamlines, isotherms, and average Nusselt numbers. 2D and 3D surface plots are also included to evaluate model performance. The code is validated by comparing present results with published numerical and experimental results.

The results indicate that the strength of flow velocity accelerates with rising Rayleigh numbers, Darcy numbers, and dimensionless time but diminishes with increasing Hartmann numbers. Heat transfer rates significantly improve with increasing Rayleigh and Darcy numbers, whereas opposite trends are observed for Hartmann numbers and dimensionless time. Thermal performance substantially improves with the simultaneous increment of Rayleigh and Darcy numbers. Positive sensitivity is recorded for input factors Ra and Da in computing, while negative sensitivity is observed for Ha and τ. These findings could provide a framework for experimental results aimed at developing high-performance convective heat exchangers.

Keywords: Magnetohydrodynamic; natural convection; Hybrid nanofluid; Cavity porosity; Finite element method; Response surface method

ICMA 78: Numerical Investigation of the Fractal-Fractional Order Model for Diabetes Mellitus Considering Media-Driven Awareness Program

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Abstract: Diabetes is rapidly emerging as a global epidemic, posing a significant threat to public health. Modeling the spread and management of diabetes is crucial for monitoring its growing prevalence and developing cost-effective strategies to mitigate its incidence and complications. This paper presents a fractal-fractional order nonlinear model for diabetes mellitus that incorporates the cumulative effect of media-driven diabetes awareness and education programs. The model is analyzed using a two-step Newtonian polynomial approach with the Caputo derivative. Key aspects such as equilibrium points, stability, and the existence and uniqueness of solutions are examined to ensure the robustness of the model. The obtained results are validated against previously published findings. Graphical and numerical results are obtained for different values of the fractional order. This research provides valuable insights for predicting disease trends and planning effective clinical management for diabetes patients.

Keywords: Fractal-fractional order; diabetes mellitus; Mathematical modeling; Epidemic model; Two-step Newtonian polynomial approach

ICMA 79: An Attack in the Elliptic Curve Discrete Logarithm Problem

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Abstract: The elliptic curve discrete logarithm problem is of fundamental importance to public-key cryptography. It is in use for a long time and is considered secure. We explore ways to solve the elliptic curve discrete logarithm problem using mostly computational results. However, it seems, the methods we develop and directions we pursue can provide a potent attack to this problem. Let F be a finite field of arbitrary characteristic. Let

$$A = \begin{pmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1d} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2d} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{l1} & a_{l2} & a_{l3} & \cdots & a_{ld} \end{pmatrix}$$

be a $l \times d$ matrix over F. Let α, β be two ordered subsets of $\{1, 2, \ldots, l\}$ and $\{1, 2, \ldots, d\}$ respectively and are of the same size k. Then we define the sub-matrix $A[\alpha|\beta]$ of A to be the square matrix of size k consisting of elements that are in the intersection of the rows in α and columns in β in A. The ordering in the sub-matrix is the same as the ordering in the matrix A. The determinant of $A[\alpha|\beta]$ is a minor of A.

A non-singular elliptic curve over F will be denoted by E. We will consider it as a plane projective curve in the projective plane P^2. It is well known that there is an abelian group operation on E with the point at infinity O as the zero element. We will use that fact and denote the abelian group by E as well. We will take the group to be E in this talk. Once we assume, the group of rational points of an elliptic curve is of order p, the next thing is to assume that it is generated by P.

Definition 1 (The elliptic curve discrete logarithm problem). Let E and P be as above. Then the elliptic curve discrete logarithm problem is: given P and $Q = mP$ in E, where $1 < m < p$, compute m.

In this talk we share a few things:

a) Finding a zero minor in an appropriate matrix, just like A, solves the discrete logarithm problem.

b) We share some success in finding a zero minor with experiments involving almost principal minor. We believe the reason behind this success is the existence of a set of initial minors. This solidifies our conjecture of initial minors.

c) We solve the discrete logarithm problem for many different large cases. Moreover, we claim that there is a successful attack in the making, using methods in this paper.

Keywords: Elliptic curve; Discrete algorithm; Cryptography; Abelian group

ICMA 80: Metrological and Demographic Influences on Dengue Outbreaks in Nepal: A Mathematical Study With PSO-RNN Approach

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Abstract: Dengue infection has become an emergent concern in Nepal and other tropical countries in recent years. Several epidemiological and mathematical studies have sought to recognize the relevant factors and establish control strategies that help with prediction and policy making. This study aims to develop a mathematical model to estimate infection rates and to assess the influence of meteorological and demographic factors on dengue outbreaks, across 30 districts in Nepal. A hybrid model, combining Particle Swarm Optimization (PSO) and Recurrent Neural Networks (RNN), is applied to monthly dengue incidence data, along with corresponding meteorological and population data, from January 2022 to October 2024. The PSO-Neural Network model, designed to predict infection rates and identify key contributing factors to dengue outbreaks, produces highly accurate forecasts with favorable statistical performance indicators. Feature importance analysis shows that temperature, altitude and population density are the most significant predictors of outbreak severity, while rainfall and humidity have moderate impacts. Socio-economic factors such as education level and healthcare access have smaller but notable effects. The strong correlation of infection rates with meteorological and demographic variables highlights the potential impacts of climate change on dengue outbreaks in geographically diverse regions. Detecting these crucial factors provides essential visions for targeted intervention strategies to control dengue in Nepal.

Keywords: Dengue; Mathematical model; Particle Swarm optimization; Neural network; Meteorological factors

ICMA 81: Image Forgery Detection Using Capsule Network Based on VGG19

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Abstract: Digital images play a crucial role in media and scientific fields, but can be forged easily, posing a risk of misinformation. CNN model uses more parameters consuming more memory and computation power and also require more training data as this model is not viewpoint equivariant. This paper is concerned on using capsule network based on VGG19 to overcome the limitations of CNN. The superiority of the capsule-forensics network is the use of pretrained feature extractor, statistical pooling layers, and a dynamic routing algorithm. This enables it to outperform similarly designed CNNs while being much smaller than CNNs with comparable performance. FaceForensics++ datasets are used for training and testing in this proposed model for binary and multiclass classification. An accuracy of 99.23% has been achieved in the binary classification of real and forged images, with a precision of 99.53%, recall of 99.64%, and an F1 score of 0.99. The multiclass classification of real, irregular swap, and deepfake image categories has achieved accuracy and precision above 90% for all categories. Recall values have been observed at 75.99% for deepfake

images, 99.51% for irregular swap images, and 83.6% for real images. The highest F1 score of 0.93 has been achieved for the irregular swap category, followed by 0.87 for real images and 0.83 for deepfake images.

Keywords: CNN, VGG19; Viewpoint equivariant; Statistical pooling; Dynamic routing algorithm

ICMA 82: Age-Based Parameters Estimation for SIR Modelling of COVID-19 in Nepal

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Abstract: This research focuses on estimating the SIR model's COVID-19 parameters in Nepal during 2022, specifically focusing on age-based analysis. The research splits the infected population into different age groups from $0-9$ years to $70-79$ years and helps to solve a major challenge: the various impacts across different regions. We estimated the value of m by using the least squares method, and we also calculated the value of β for each age interval using the formula $m = \beta - \gamma$, where γ = recovery rate for each age group and β = transmission rate of infection. The research uses a systematic approach to understand how the pandemic affects various age groups differently. Pandemics, as we have studied with COVID-19, do not affect all age groups equally, and this research reinforces the need for age-specific interventions. With the help of age-dependent recovery rates, this research focuses on the varying age groups. After calculating beta and gamma values, we have simulated SIR model trajectories using Mathematica. The Mathematica graph illustrates the trend of infected, susceptible, and recovered populations from January 2022 to March 2022. This method enables the prediction of how these populations evolve. This study highlights the significance of agewise analysis in understanding how pandemic dynamics impact different age groups. This technique functions as an essential and flexible tool for public health policy and planning, enabling its applications for various infectious illnesses.

Keywords: SIR model; Transmission rate; Recovery rate; COVID-19; Epidemiological simulation

ICMA 83: Construction Of Almost Unbiased Estimator For Parameter β Using Auxillary Information Under Simple Random Sampling

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Abstract: The present study focuses on estimating the regression coefficient β in a finite population using a simple random sampling procedure, in which every member of the population has an equal chance of being selected. In this paper, we have proposed an almost unbiased estimator in case of regression coefficients i.e. β . For this, we have taken the β as usual estimator suggested by Srivastava et al. (1986) and two others estimators which are suggested by Sukminder and Sarjinder (1988). For the validation of theoretical result, we have used two data sets and one simulation study. The estimators' performance has been verified by applying the percent relative efficiency (PRE) and mean squared error (MSE) criteria. Results show that, in comparison to the other estimators, the proposed class of estimators shows more efficiency and is almost unbiased up to the first order of approximation.

Keywords: Finite population; Regression coefficient; Unbiased estimators; Mean square error; Percent relative efficiency

ICMA 84: Optimising Differential Equation Solutions Using Physics-Informed Neural Networks (PINNS): A Comparative Study

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Abstract: This paper examined sophisticated computational approaches for solving differential equations, particularly on physics-informed neural networks (PINNs). Initially, the method involved building neural networks with different activation functions and configurations, varying the number of neurons and data points in buried layers to produce shallow or deep networks. The neural network output was used to approximate the solution of the differential equations. A cost function represented the differential equation called the residual, which included pertinent boundary conditions. Several numerical optimisation approaches were used to minimize this cost function and attain the required accuracy. Blasius flow, one-dimensional heat and wave equations, mass-spring systems, and other academic and benchmark issues were used to test the methodology. The outcomes of the PINNs were contrasted with those of different numerical techniques and exact answers. The results showed that PINNs can outperform conventional numerical methods in accuracy. However, getting high accuracy fast necessitates employing highly designed computational systems, as simpler systems may fail to achieve the needed precision in a reasonable time frame.

Keywords: Neural network; Activation functions; PINNs; Differential equations

ICMA 85: Experimental Slowflow and Numerical Simulation of Slowflow Model

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Abstract: Slowflows, a specific type of earthflow characterized by gradual movement over extended periods, have received limited attention compared to fast-moving phenomena such as avalanches, rockfalls, and debris flows. Increasing cases of earthflows, driven by destabilizing factors like global warming, earthquakes, and prolonged rainfall, necessitate a deeper understanding of these processes. This study combines experimental and numerical approaches to investigate slowflow dynamics. Laboratory experiments use a highly viscous material, molten jaggery, to simulate initiation, gradual movement, and long-term morphological evolution of slowflows. A computational model, based on the framework proposed by Pudasaini and Mergili (2024), is applied to analyze the flow dynamics numerically. Experimental results reveal critical aspects of slowflow behavior, including key mechanisms and long-term trends. Numerical simulations validate the experimental findings and offer additional insights into the processes involved. These results contribute to a systematic understanding of slowflow dynamics and provide valuable knowledge for predicting and mitigating earthflow-related hazards.

Keywords: Slowflow; Earthflow; Viscosity; Experimental simulation; Numerical simulation

ICMA 86: Heat and Mass Transfer Effects on Non-Newtonian Nanofluid Flows

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Abstract: Fluid dynamics, a subcategory of fluid mechanics, explores fluid flow phenomena and extends into advanced regimes such as hypervelocity flight and electrically conducting fluid flow. This broad scope introduces new areas of interest, including hypersonic flow and hydrofluid dynamics, requiring a multidisciplinary understanding encompassing thermodynamics, heat and mass transfer, electromagnetic theory, and fluid mechanics. The transfer of heat and its associated convection instabilities significantly impact fluid systems, necessitating effective mechanisms to control convection and optimize heat and mass transfer processes. This study focuses on these mechanisms within the context of saturated porous media, a topic of significant relevance to engineering and geophysical applications. The findings contribute to a deeper understanding of heat and mass transfer effects in non-Newtonian nanofluid flows, with implications for controlling instabilities and enhancing system efficiency.

Keywords: MHD; Heat and mass Transfer; Nanofluid

ICMA 87: Mathematical Analysis of Alcoholism as a Communicable Disease with Time Delay

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Abstract: This study presents a non-linear mathematical model incorporating time delay to analyze the impact of awareness programs, delivered through various media, on the spread of alcoholism in society. The model assumes that alcoholism, characterized by heavy drinking habits, spreads through contact between susceptible individuals and heavy drinkers. The growth rate of awareness programs is modeled to be proportional to the heavy drinking population, and these programs influence susceptible individuals to join an "aware" class, reducing their likelihood of becoming heavy drinkers. Time delay is incorporated to account for the non-instantaneous transition from susceptibility to heavy drinking. The stability theory of differential equations is applied to analyze the model, revealing that while awareness programs can effectively control the spread of alcoholism, the habit persists endemically in the community. Simulation results further confirm the analytical findings, emphasizing the critical role of targeted interventions in mitigating the spread of alcoholism.

Keywords: Equilibrium point; Basic reproduction number; Sensitivity analysis; Simulation

ICMA 88: Comparative Study of Advanced Analytical Methods for Solving Fractional Differential Equations

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Abstract: This study conducts a comparative analysis of two advanced analytical techniques for solving fractional differential equations: the q-Homotopy Analysis Generalized Integral Transform Method (q-HAGITM) and the Generalized Integral Transform Adomian Decomposition Method (GITADM). Focusing on fractional Navier–Stokes equations as a test example, the study evaluates each method's effectiveness and computational efficiency. Solutions are presented graphically to improve interpretability and highlight the practical applications of these techniques. The analysis reveals that both methods handle various series solutions with high stability and accuracy. A significant advantage of q-HAGITM lies in its convergence parameter, which offers flexible control over the convergence region and optimizes the solution's adaptability. This comparative study underscores the q-HAGITM's potential as a robust tool for extending analytical solutions in complex fluid dynamics, supported by numerical and visual data that confirm its advantages.

Keywords: Caputo fractional derivative; Fractional Navier–Stokes system; Generalized integral transform; Homotopy analysis transform method; Generalized integral transform adomian decomposition method

ICMA 89: New ArcTan-Family of Distribution, Properties, and Application

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Abstract: This study introduces a novel family of univariate probability distributions, termed the New ArcTan (NAT) family, designed to enhance flexibility and applicability across diverse datasets. The cumulative distribution function (CDF) of the NAT family is defined as $F(x,\theta,\lambda) = \frac{1-e^{-\lambda \tan^{-1}(G(x,\theta))}}{1-e^{-\lambda\pi/4}}$. A sub-model, the two-parameter NAT-Weibull distribution, is derived using the Weibull distribution as a base. The paper explores key statistical properties, methods for random number generation, and reliability analysis of the proposed distribution. The hazard rate function of the NAT family exhibits a unique bimodal curve. The method of maximum likelihood estimation is also derived to estimate the model parameters. Practical applicability is demonstrated through two real-world examples involving remission times and melanoma data. These

applications underscore the robustness and utility of the NAT-Weibull distribution in modeling complex datasets effectively.

Keywords: ArcTan; Hazard rate function; Likelihood function; Melanoma; Reliability function; Remission times; Weibull distribution

ICMA 90: Fundamental Solution to a Universal Dispersive Wave Equation

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Abstract: This study presents a novel universal dispersive wave equation that integrates flow depth and velocity into a single, composite, highly non-linear partial differential equation to model landslide mechanics and dynamics comprehensively. Exact analytical solutions to this equation are derived in the form of fundamental solutions, offering intrinsic functional relationships between flow velocity and depth. These relationships enable estimation of one parameter given the other, representing a significant advantage of the fundamental solution. A demonstrative example is provided to highlight the structure of the solution in a plausible physical context, revealing fascinating wave dynamics such as amplified high-dispersion waves propagating along a slope over time. Simple, physically-constrained analytical solutions are also constructed to describe dispersive wave phenomena in landslide motion. The mathematical consistency and physical relevance of these solutions are validated, demonstrating the profound influence of boundary conditions on wave structure. The study underscores the necessity of accurately selecting physical parameters to describe dispersive wave dynamics in mass transport systems. Finally, the potential applications and physical insights provided by these models and solutions are discussed.

Keywords: Non-hydrostatic mass flow; Dispersive wave in landslide; Universal dispersive wave equation; Fundamental solution; Analytical-exact solution

ICMA 91: Effect of Using Wolfram Alpha on Students' Cognitive Engagement

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Abstract: Cognitive engagement, a multidimensional construct, significantly influences students' academic performance. This study explores the effect of using Wolfram Alpha in teaching and learning mathematics on the cognitive engagement of secondary-level students. Employing a quasi-experimental design with a pretest-posttest non-equivalent group approach, the study involved 64 class 11 mathematics students from two institutional schools in Butwal Sub-Metropolitan City. Data were collected using adapted questionnaires - Cognitive Engagement Scale Extended Version (CSE-E) and Students Opinion Scale (SOS) - modified to fit the study's context. Analysis using independent t-tests and ordinal logistic regression revealed that students taught mathematics using Wolfram Alpha demonstrated higher levels of cognitive engagement compared to those who did not use this technology. These findings suggest that integrating Wolfram Alpha into mathematics teaching and learning positively impacts students' cognitive engagement, offering valuable insights for educators, researchers, and mathematics teachers to enhance student engagement through educational technology.

Keywords: Wolfram alpha; Quasi-experimental; Cognitive engagement; Educational technology; Academic performance

ICMA 92: On Some Sequence Spaces of Bi-Complex Numbers

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Abstract: This article provides an overview of bi-complex numbers and examines the completeness of certain sequence spaces of bi-complex numbers. Additionally, the study explores their algebraic, topological, and geometric properties, contributing to a deeper understanding of these spaces. The research focuses on the relationships and structural aspects that make bi-complex numbers a fascinating subject in the context of Banach spaces and convexity.

Keywords: Bi-Complex numbers; Banach spaces; Euclidean norm; Convexity; Uniform convexity

ICMA 93: Applications of Galois Theory

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Abstract: This paper provides an overview of Galois theory and discusses its applications in both pure and applied mathematics. We begin by applying the fundamental theorem of Galois theory to compute the Galois groups of polynomials and demonstrate the non-existence of a general formula for solving polynomial equations with rational coefficients for degrees $n \geq 5$. The study also explores the use of Galois fields, specifically finite fields, in error-correcting codes and cryptography in computer science. Although there are no general rules for computing Galois groups of polynomials of degree greater than four, two new examples of such Galois groups are presented. Additionally, the concept of the Galois group of a single-variable polynomial is extended to multi-variable polynomials. This paper highlights the profound relationship between field theory and group theory through the fundamental theorem of Galois theory and its evolution from pure mathematics to its applications in computer science.

Keywords: Fundamental theorem; Galois extension and Galois group; Galois field; Error-correcting codes; Advanced encryption standard

ICMA 94: Mathematical Study of Impact of Non-Signalized Road Crossing on Vehicular Emissions and Fuel Consumption

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Abstract: Emissions from vehicles, particularly automobiles, contribute significantly to urban air pollution, accounting for around two-thirds of it. The primary pollutants, such as carbon monoxide (CO), nitrogen oxides (NOx), and hydrocarbons (HC), have detrimental effects on both human health and the environment. At road intersections, especially where pedestrian and vehicular traffic interact, congestion often arises, causing vehicles to idle or move at slower speeds. This increases fuel consumption and pollutant emissions. This paper investigates the impact of vehicle-pedestrian interactions at non-signalized road crossings on vehicular emissions and fuel consumption using numerical simulations based on car-following models. By fitting available data through the method of least squares, we derive models for emissions (NOx, CO, HC) and fuel consumption against instantaneous speed over time. The resulting model estimates the rate of emissions and fuel consumption per kilometer for different vehicle types, with and without interactions at non-signalized intersections. Additionally, the study compares the average emissions and fuel consumption of various vehicle types with published literature data.

Keywords: Vehicular emission; Fuel consumption; Intersection; interaction; Car-following models

ICMA 95: Forecasting of Cognitive Neuroscience Using Machine Learning Hybrid Models

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Abstract: Individual differences in cognitive and neurocognitive impairments are observed across individuals, and these differences are influenced by a reserve or defense mechanism that strengthens the brain's resistance to age-related damage. According to the Neurocognitive Hypothesis in cognitive neuroscience, this reserve develops through intellectually demanding activities and lifelong experiences. The statistical and machine learning modeling presented here explains how the neurocognitive reserve impacts changes in brain architecture, neurons, and neural activation patterns due to age and individual-related factors. The modeling is based on behavioral and neuroimaging findings, with preliminary results from structural and functional neuroimaging supporting the idea that neurocognitive reserve functions as a neural resource, reducing the impact of cognitive decline caused by aging, neurological, and psychological diseases. The paper emphasizes that neurocognitive reserve offers a dynamic view of resilience, demonstrating the ability to adjust to brain illness and damage as predicted by statistical models. Although the processes outside the model are not fully understood, the study advocates that predictive modeling can aid future research in identifying the elements that support neurocognitive reserve's positive impacts in delaying cognitive decline and fostering psychological resilience in old age.

Keywords: Cognition; Resilience; Correlation studies; Modeling algorithms

ICMA 96: Minimum Degradation of Demand Supply to Make Feasible Flow with Minimum Cost Flow

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Abstract: In a minimum cost flow problem, a commodity is transported through a network to meet the demands at specific nodes from available supplies at other nodes, while minimizing the cost of shipment. In some situations, demands are not fulfilled due to inadequate capacity of the edges, i.e., the flow is infeasible. To achieve a feasible flow, we have two options: the first is to increase the capacity of certain edges at an additional cost. The second option involves reducing the

demand and supply when necessary. Our goal is to minimize this reduction while maintaining feasible flow at the lowest possible cost. To address this problem, we develop an algorithm and solution strategy to solve the problem and assess its efficiency. The solution involves formulating the problem as a minimization problem, developing an algorithm to minimize the reduction in demand and supply, and implementing a flow network to calculate the optimal flow solution. The effectiveness of the proposed solution is demonstrated through numerical simulations and practical examples, showing its ability to handle various scenarios of flow infeasibility and cost optimization.

Keywords: Minimum cost flow; Network flow; Infeasible flow; Reduction in demand/supply

ICMA 97: Mathematical Model for Crimes in Goa with Some Governing Design

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Abstract: Crime is one of the most challenging problems, particularly when unemployment is prevalent. Not all types of crimes can be eradicated; however, this paper aims to contribute to the reduction of unemployment-related crimes in Goa by proposing a deterministic mathematical model that incorporates unemployment-crime dynamics. The model includes vocational training and employment as control measures to combat crime. The study uses epidemiological model concepts for formulation and analysis, where unemployment is considered the primary driver of crime. The basic properties of the model are analyzed, and the Criminal Reproduction Number is derived to establish conditions for the local and global stability of the model. Simulations validate the theoretical aspects of the model and demonstrate that vocational training and employment strategies are more effective in reducing crime when applied simultaneously. The findings highlight that addressing the unemployment problem is crucial in reducing the number of individuals turning to criminal activities.

Keywords: Crime; Deterministic model; Epidemiological model; Criminal reproduction number; Stability

ICMA 98: Numerical Study of Burgers Equation and Its Application

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Abstract: This numerical study investigates the nonlinear Burgers equation, focusing on the effects of nonlinear terms on the solution and its regularity using the pseudospectral method. The study also explores various applications of the equation in real-world scenarios, providing insights into its behavior and potential solutions.

Keywords: Burgers equation; Viscosity; Nonlinearity; Pseudospectral method

ICMA 99: Trend and Determinants of Fertility Dynamics in Bangladesh

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Abstract: Fertility is an essential component in understanding a country's population dynamics. This study investigates various factors affecting fertility. The objectives of this study are twofold: first, to examine the trend of fertility through birth interval data, and second, to identify the key determinants of fertility dynamics. This research utilizes records from the BDHS and the World Bank dataset, implementing Cox proportional hazard models and parametric frailty models to find determinants of fertility. ARIMA models are used to analyze the trend of the Total Fertility Rate (TFR). The study finds that the TFR in Bangladesh decreased steadily from 1980 to 1995, followed by a slight increase until 1997, after which it declined again up to 2022. Projections show that the TFR will slow down to around 1.7 by 2035 and stabilize around 1.5 until 2050. The study also identifies significant factors influencing fertility, including the mother's age at marriage, age at first pregnancy, education level, employment status, parity, and place of residence. In conclusion, the study highlights the importance of socioeconomic factors in shaping fertility patterns and emphasizes the decline in TFR in Bangladesh, with education, employment status, and place of residence playing crucial roles.

Keywords: Birth-Interval; TFR; Fertility

ICMA 100: Paul Erdős's Two Conjectures' Proof Progress in Hypergraphs

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Abstract: Hypergraphs, a generalized version of traditional graphs, have applications ranging from social networking to modeling protein complexities. The Erdős–Faber–Lovász Conjecture, which states that the chromatic number of a union of n pairwise disjoint complete graphs is at most n, and the Erdős–Gyárfás Conjecture, which suggests that every graph with minimum degree 3 contains a cycle of length that is a power of 2, are both highlighted here. The Erdős–Faber–Lovász Conjecture was recently solved by Dong Yeap Kang's team for every large n vertices, while the Erdős–Gyárfás Conjecture remains unsolved but has been proved partially for cubic planar graphs and certain families of Cayley graphs. A review of the verification process and justifications are presented in this paper.

Keywords: Hypergraphs, Erdős–faber–Lovász conjecture, Erdős–Gyárfás conjecture

ICMA 101: A Note on Evaluation of a New Class of Integrals Involving Generalized Hypergeometric Function

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Abstract: In the theory of hypergeometric and generalized hypergeometric series, classical summation theorems such as those of Gauss, Gauss second, Bailey, and Kummer for the series ${}_2F_1$; Watson, Dixon, Whipple, and Saalschütz play a key role. Applications of the above-mentioned summation theorems are well known. In our present investigation, we aim to evaluate twenty-five new classes of integrals involving generalized hypergeometric functions in the form of a single integral of the form:

$$\int_0^{\pi/2} e^{2w\cos\theta}(\sin\theta)^{c-1}(\cos\theta)^{c-1}{}_3F_2\left[\begin{matrix}a,b,c\\ \frac{1}{2}(a+b+c),\ 2c+j\end{matrix};-4we^{2w\theta}\sin\theta\cos\theta\right]d\theta,$$

For $i,j=0,\pm1,\pm2$ with $w=\sqrt{-1}$.

The results are established with the help of the generalizations of the classical Watson's summation theorem obtained earlier by Lavoie et al. Fifty interesting integrals in the form of two integrals (twenty-five each) have also been given as special cases of our main findings.

Keywords: Generalized hypergeometric function; Watson's theorem; Definite integral; Beta integral

ICMA 102: A Result on an Integral Involving Product of Two Generalized Hypergeometric Functions

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Abstract: This research work aims to present an interesting integral that involves the product of generalized hypergeometric functions. This is accomplished using a well-established integral for hypergeometric functions found in existing literature. Several prior results by Harsh et al. emerge as particular cases of the primary findings presented here. The derived general expression provides a powerful tool for further advancements and simplified proofs in related studies.

Keywords: Gauss's Hypergeometric function; Gamma function; Generalized hyper geometric function, Watson theorem, Definite integral

ICMA 103: Few Theorems on an Extension of Bailey's Formula Involving Product of two Generalized Hypergeometric Functions

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Abstract: In this work, we investigate extensions of Bailey's formula by presenting a set of new theorems involving the product of two generalized hypergeometric functions, motivated by the papers of Kim et al. and Rakha et al. Our approach involves two interesting extensions of Bailey's identity through an innovative construction of hypergeometric products. A few well-known results follow as special cases of our main findings.

Keywords: Generalized hyper geometric series; Kummer's type II transformation; Bailey's identity; Contiguous results

ICMA 104: Fixed Point Theory and Compatible Mappings of Type (K)

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Abstract: Fixed point theory is an important part of functional analysis. The study of common fixed point of mappings satisfying contractive type conditions has been a very active field of research during the last four decades. In 2014, K. B. Manandhar, K. Jha and V. Popa introduced the concept of compatible mappings of type (K) in metric space and fuzzy metric space. The purpose of this paper is to study the different types of compatible mappings and compatible mappings of type (K) in metric space and fuzzy metric space.

Keywords: Common fixed point; Compatible mappings; Compatible mappings of type (K)

ICMA 105: Certain Fixed-Point Theorems in Gb-Metric Space

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Abstract: Today the fixed-point theory is playing a significant role in mathematics and applied sciences. several fixed and common fixed-point outcomes in the structure of G-metric space was obtained generalized by many scholars. The main aim of our research paper is to obtain existence and uniqueness of fixed point by using different contractive mappings in Gb- metric space. Our results are the extensions of the results in the literature. We also provided an example which support our results.

Keywords: Fixed point; G-metric space; Gb-metric space; Cauchy sequence

ICMA 106: Performance Analysis of Finite Capacity and Multiple Server Queueing System with Maintenance

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Abstract: This study explores implementing an M/M/c/K queueing system with two service interruptions: regular maintenance and customer feedback maintenance. Regular maintenance is carried out when a server is in an idle state. Any technical issues with the server could lead to customer's dissatisfaction and goes for feedback maintenance. Various customer feedback scenarios are addressed through an adaptable approach. Utilizing a matrix-analytic method, the steady-state probabilities of the queueing system have been computed, and key performance metrics such as average numbers of customer and waiting times have been established. The model has significant implications for sophisticated manufacturing systems.

Keywords: Finite capacity; Multiple servers; Maintenance; Feedback

ICMA 107: Learners' Reflection on Intricacies of Learning Mathematics: An Observation in Sanskrit Schools

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Abstract: This paper aims to present the intricacies of Mathematics learning from the perspective of learners in Sanskrit schools. Moreover, it attempts to acknowledge what factors influence in making Mathematics a subject of problem among the community of learners in the Sanskrit schools of western Nepal. This paper employs constructivist theory to observe and solve learning intricacies of Mathematics. This theory thoroughly examines the pedagogical application and rapport between teachers and students. After this observation, this theory is then used to disclose different problems why learners in this school consider learning is difficult and offer solutions to this phenomenon.

Keywords: Mathematics; Learning complexity; Perspective; Constructivist theory; Pedagogical application

ICMA 108: Hindu Mathematics in the Later Classical Period

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Abstract: Hindu mathematics from the later classical period (500–1200 CE) represents a golden era in the development of mathematical thought in South Asia, marked by the contributions of numerous scholars who laid foundational principles that influenced mathematics globally. This period saw advancements in arithmetic, algebra, geometry, trigonometry, calculus, and astronomy, each evolving through distinct schools and texts. Key figures such as Varāhamihira, Bhāskara I, Brahmagupta, Mahāvīra, Śrīdhara, Āryabhata II, Śrīpati, and Bhāskara II developed methods that offered new insights and computational techniques. This paper aims to provide an overview of their contributions, emphasizing their mathematical methods, results, and their impact on future mathematical thought.

Keywords: Hindu mathematics; Classical period; Brahmagupta; Mahāvīra; Bhāskara II

ICMA 109: Causes of Low Enrollment and Dropout of Students in University Level Mathematics in Nepal

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Abstract: Low enrollment and dropout of students in university level mathematics in Nepal has been a global. This paper aims to identify the causes of low enrollment and dropout of students in university level mathematics in Nepal. This survey study was conducted in Mid-West (MU) and Far-West University (FWU) of Nepal. All the students studying mathematics in undergraduate and graduate level of MU and FWU are the population of this study. Among them, 50 students were selected randomly representing Education, Humanity and Science faculties of both universities. Closed-type questionnaire was used as the tool of data collection. Collected quantitative data was analyzed using mathematical tools like as percentage, bar graph in descriptive way. The result indicated that lack of scope in other fields, lack of facilities in teaching profession and theoretical nature of course and are the main causes of low enrollment and dropout of students in university level mathematics.

Keywords: Enrolment; Dropout; Facility; Nature; Causes

ICMA 110: Comprehensive Study on Particle Swarm Optimization and its Applications

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Abstract: The 21st century is the age of science and technology. Many human jobs have been replaced by artificial intelligence (AI). AI is used in all commercial, industrial, and agricultural sectors. Nowadays, use of AI is increasing rapidly. Optimization is a mathematical technique focused on identifying the maximum or minimum values of a function within a defined feasible region. Particle Swarm Optimization (PSO) is a stochastic optimization algorithm that is based on the flocking behaviour and social cooperation of birds and fish schools. This algorithm is motivated by the intelligent collective behaviour of such animals and birds, which is the branch of artificial intelligence. In this research, we briefly study a PSO and highlight its application in different fields with advantages.

Keywords: Swarm Intelligence; Particle swarm algorithm; Artificial intelligence; Genetic algorithm; Hybrid metaheuristic method

ICMA 111: On Certain Types of Difference Sequence Spaces Defined by Orlicz Function and Ideal Convergence

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Abstract: In mathematical analysis and related subject area of mathematics, a sequence space is a special case of function space if the domain is restricted to the set of natural numbers. The sequence spaces and function spaces have various applications in different branches of mathematics. They have prominent position mainly in analysis, for instances, in structure theory of topological linear spaces, summability theory, operator theory, frame theory, Schauder basis theory, approximation theory, etc. Sequence space is a linear space whose elements are infinite sequences of real or complex numbers. Equivalently, the set ω of all functions from the set of natural numbers N to the field K of real or complex numbers can be turned into a vector space. A sequence space is defined as a linear subspace of ω. Let l^{∞}, c_0, and c be the linear spaces of bounded, null, and convergent sequences with complex terms respectively and the norm in these spaces is given by $\|x\| = \sup_k |x_k|$, $k \in N$.

In this presentation, we discuss the difference sequence spaces defined by Orlicz function and Ideal convergence. In fact, these spaces are the successive natural generalizations of well-known sequence spaces c_0, c, and l^∞. Moreover, we explore some of the linear topological structures of these spaces when topologized with suitable natural norm.

Keywords: Orlicz function; Orlicz sequence space; Difference sequence space; Ideal convergence

ICMA 112: Externalities in Chore Division

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Abstract: Fair division is one of the most fundamental and well-studied topics in computational social choice theory and has received significant attention in the domains of mathematics, economics, political science, and computer science. Fair division problems are of particular interest because of their various real-world applications, such as students sharing the cost of renting an apartment, spouses sharing assets after divorce, and nations claiming ownership of disputed territories. Research discussions on fair division often explore between two distinct categories of items. Certain items, such as cake and land, are considered divisible due to their ability to be divided among agents in an arbitrary manner. Additional items, such as residences and automobiles, possess indivisible characteristics, necessitating their allocation in their whole to a single agent.

We study the chore division problem which simulates the fair division of a heterogeneous, undesirable resource among several agents. In the fair division of chores, each agent only gets the disutility from its own piece. Agents may, however, also be concerned with the pieces given to other agents; these externalities naturally appear in fair division situations. We first demonstrate the generalization of the classical concepts of proportionality and envy-freeness while extending the classical model by taking externalities into account. Our results clarify the relationship between these expanded fairness conceptions, evaluate whether fair allocations exist, and examine whether fairness in the face of externalities is computationally feasible. In addition, we present tractable methods to achieve the most efficient and fair allocations under different assumptions about agents' disutilities.

Keywords: Fair division; Cake cutting problem; Externality; Game theory; Economics

ICMA 113: Investigating Students' Perceptions of Self-Directed Learning in Mathematics at the Basic School Level

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Abstract: Self-directed learning (SDL) is an educational approach, where individuals take initiative and responsibility for their own learning, choosing what, how, and when to learn. It is assumed that SDL empowers students to tailor their educational experiences to personal interests and pace of learning, fostering autonomy and lifelong learning habits. This study aims to investigate on students' attitudes toward SDL in mathematics at basic school level using quantitative research design (survey). The data were collected from students using SDL attitude scale. Total population of the survey consists of students from six public and eight private schools, out of which students from two purposefully selected schools from each category for the sample. From the four schools, 120 students were selected. Attitudes towards SDL in mathematics scale developed by the researchers were applied to collect the data and were analyzed using SPSS version 26 based on the research questions. The study revealed that students had negative attitudes toward self-management, self-monitoring, and self-motivation as required for SDL in mathematics at the basic level school. Moreover, there is no significant difference in students' attitudes toward SDL in mathematics between public and private schools, and between male and female students. The result shows that students' attitudes towards SDL change positively as they participated in different teaching learning techniques applied for engaging them in learning such as KWL, jigsaw, reciprocal teaching, think-share-pair, and cooperative, and collaborative instruction. This implies that negative attitude towards a pedagogical approach does not mean that students pay less attention to the approach but changes when applied appropriately.

Keywords: Self-directed learning; Mathematics; Attitudes; Bbasic level; Instructional strategy

ICMA 114: A Rigorous Mathematical Analysis to Explore the Density of Tumour Cells and Immune Response

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Abstract: A model for cancerous growths, especially on solid tumour, in which growth primarily comes from cellular proliferation is designed here. A procedure

for cancer therapy which consists of an interaction between immune response (immune cells) and tumour cells without any specific drug is considered. The idea of this research work is to establish a mathematical analysis of the model and to explore the density/concentration of tumour cells and immune response (TNF-tumor necrosis factor). The result suggests that although tumor cell dissociation (TCD) is capable of the growth of tumors the immune response is blocked to direct tumor growth. Two factors need to be considered for such predictions: net growth rate and infiltrative ability in this model. The result suggests that although TCD is responsible for the growth of tumors the immune response is stopped to direct tumor growth.

Keywords: Tumor cells; Immune response; Concentration; Cancerous growth

ICMA 115: Predictive Accuracy of Time Series and Machine Learning Models: An Application to Life Expectancy at Birth Data

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Abstract: The forecasting of accurate life expectancy becomes needs of the hour as it is one of the critical issues taken into consideration to plan different public health policies in any developing country. The purpose of this study is to forecast life expectancy at birth for males, females and total population using autoregressive integrated moving average (ARIMA) and artificial neural network (ANN) with multilayer perceptron (MLP) models and compare their prediction accuracy in terms of root mean square error (RMSE) and mean absolute percentage error (MAPE) to suggest the better model for prediction. The Box–Jenkins (B–J) methodology was applied to fit the ARIMA model, it used the stationary stochastic processes. On the other hand, a MLP algorithm was used to fit the ANN model. We have used publicly available data from 1960 to 2022 to predict life expectancy at birth in India. The results of the ARIMA(3, 2, 2), ARIMA(3, 1, 0) and ARIMA (2, 2, 1) showed that life expectancy at birth will increase by 3.1 percent, 5.1 percent and 4.4 percent for males, females, and total population, respectively, during 2023–2032. The results of the MLP models comprised of 14 input nodes, 6 hidden layer nodes and 1 node in the output layer showed that life expectancy at birth will increase by 4.4 percent, 6.8 percent and 5.2 percent for males, females, and total population, respectively, during 2023–2032. This study concludes that the ANN with MLP models perform better than the conventional ARIMA models with least prediction error.

Keywords: Forecasting; Autoregressive integrated moving average; Artificial neural network; Multilayer perceptron; Life expectancy

ICMA 116: A Comparative Study of Road Traffic Accidents in India: Analysing the National Trends

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Abstract: Road traffic accidents (RTAs) are a pressing public health challenge in India, contributing significantly to injury, disability, and mortality rates. The situation is worsened by rapid urbanization and rising vehicle density, positioning India among countries with the highest RTA rates globally. This study aims to analyze national data to identify patterns and contributing factors associated with RTAs, facilitating the development of effective prevention strategies. A retrospective analysis of RTA data from both government and non-government sources over the past five years was conducted, examining accident frequency, fatalities, injuries, demographics, vehicle types, and accident timing and locations. Statistical tools were employed to discern trends and correlations within the dataset, shedding light on causative factors and primary risks. The findings reveal a troubling consistency in both the frequency and severity of RTAs, with a significant toll on the healthcare system and socio-economic structures. Demographic analysis indicates that young adults and males are disproportionately affected, while specific vehicle types, particularly two-wheelers and heavy vehicles, are often involved in serious accidents. In conclusion, RTAs represent a substantial public health and socio-economic burden in India. The study underscores the urgent need for targeted interventions, including enhanced traffic law enforcement, improved road infrastructure, and increased public awareness campaigns. Comprehensive road safety strategies are essential to reduce the incidence of RTAs and mitigate their impact on Indian society.

Keywords: RTA; Public health; Retrospective analysis; Prevention strategies

ICMA 117: A Mathematical Modelling of Blood Flow through Artery with Bell-shaped Stenosis

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Abstract: This study investigates the effect of bell-shaped stenosis on blood flow within arteries, a critical factor in understanding cardiovascular health. Using the Navier-Stokes equation in cylindrical polar coordinates, we derive analytical solutions for key hemodynamic parameters, including velocity, pressure, pressure drop ratio, and wall shear stress. Numerical integration is applied to explore the dynamics of pressure drop, and shear stress ratios within the stenotic region and various flow parameters are investigated and analyzed in this work. Given the heightened risk posed by bell-shaped stenosis in conditions like ischemic heart disease and stroke, this research offers valuable insights into the behavior of blood flow in stenotic arteries. The findings contribute to the development of advanced analytical tools and therapeutic strategies in cardiology and bio-fluid mechanics, enhancing our ability to manage and treat cardiovascular diseases.

Keywords: Bell-shaped stenosis; Numerical integration; Volumetric flow rate; Pressure drop; Shear stress

ICMA 118: On New Space of Vector-Valued Generalized Bounded Sequences Defined on Product Normed Space

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Abstract: In this presentation, we introduce a new space of vector-valued generalized bounded sequences defined on a product normed space, denoted by

$$l_\infty(X \times Y, \mathrm{eq}\backslash o(-), \mathrm{eq}\backslash o(u,-), \|\cdot\|)$$

This space consists of sequences whose terms belong to the product of two normed spaces, X and Y, and are bounded under specified conditions on generalized sequences. We investigate the linear structure of this space, analyzing its properties under coordinate-wise vector operations, and derive conditions on the parameters

$$\mathrm{eq}\backslash o(u,-) \text{ and } \mathrm{eq}\backslash o(-)$$

that determine the inclusion relationships between

$$l_\infty(X \times Y, \mathrm{eq}\backslash o(-), \mathrm{eq}\backslash o(u,-), \|\cdot\|).$$

and other related classes of vector-valued sequence spaces. Our results contribute to the understanding of sequence spaces in the context of product-normed spaces, offering new insights into their structure, inclusion criteria, and potential applications in functional analysis and related fields.

Keywords: Sequence space; Generalized sequence space; Product-normed space

ICMA 119: Dynamics of Almost Abelian Holomorphic Semigroups

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Abstract: Some preserved structure, properties, and findings related to dynamical behaviors of almost abelian holomorphic semigroups are studied and highlighted under some prescribed condition(s). One of the dynamical behaviors is: a transcendental semigroup S is almost abelian if and only if its conjugate semigroup S' is almost abelian. Our researchable open problem about almost abelian semigroups may be: "Let S be a holomorphic semigroup generated by a transcendental entire function and if for each $g \in S$, $I(S) = I(g)$. Then S is almost abelian."

Keywords: Holomorphic semigroup dynamics; Commutator; Conjugate holomorphic function; Almost abelian semigroup; Fatou; Julia and escaping sets

ICMA 120: On Some Applications of Metric Spaces

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Abstract: The notion of "Metric Space" was introduced by French mathematician Maurice Fréchet (1878-1973) in 1906. These are the most general settings for studying any of the concepts of mathematical analysis and geometry, with applications in several domains. The objective of this presentation is to discuss some applications of metric spaces.

Keywords: Metric space; Distance; Application

ICMA 121: Modeling Within-Host Co-Infection Dynamics of SARS-COV-2 Infection Underlying HIV Infection

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Abstract: The human immunodeficiency virus (HIV) co-infection with SARS-COV-2 has been reported in many patients around the world. This has raised the alarm for the importance of understanding the dynamics of co-infection and its impact on the lives of patients. It is found that the risk of developing severe or fatal COVID-19 was 30% greater in PLHIV (People Living with HIV) compared to people without HIV infection. Here we are trying to develop the within-host co-infection mathematical model which will help us to observe the viral dynamics of SARS-COV-2 in immune-challenged persons. This model will also highlight that HIV patients are at greater risk of suffering from severe COVID-19 when infected.

Keywords: HIV; SARS-COV-2; Within host; Co-infection

ICMA 122: Multi-Commodity Flow Location Problems With Solution Strategy

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Abstract: The multi-commodity flow problem maximizes the flow of various commodities from designated sources to corresponding sinks, adhering to capacity limitations. In a contraflow network, this flow can be further enhanced by reversing the direction of arcs toward the sinks. The Flow Location (FlowLoc) problem, meanwhile, aims to minimize the reduction in maximum flow by optimally placing a set of specified facilities within the network.

In this presentation, we merge these concepts to introduce the maximum static multi-commodity FlowLoc problems for both single and multiple facility scenarios. While the single facility problem is solvable in polynomial time, the multi-facility problem is NP-complete. To approximate a solution for the multiple-facility problem, we employ a polynomial-time heuristic. We also extend these results to contraflow networks.

Keywords: Multi-commodity flow; FlowLoc; Contraflow; NP-complete; Heuristic

ICMA 123: Dual Satellites: Orbital Dynamics

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Abstract: This study investigates the combined effects of Earth's oblateness and magnetic forces on the trajectories and dynamics of two satellites in orbit. Earth's oblateness, a result of its equatorial bulge, significantly influences gravitational potential and orbital mechanics. Concurrently, the magnetic field exerts forces that affect satellite systems, particularly those equipped with magnetometers and other sensing instruments. We analyze how these two factors interact to impact orbital stability, altitude decay, and satellite performance. Our findings reveal that the effects of oblateness and magnetic forces can lead to observable variations in satellite orbits, which have implications for satellite positioning, communication, and mission planning. The orbital mechanics in the context of non-uniform gravitational fields and magnetic environments provide valuable insights for future satellite design and deployment strategies.

Keywords: Satellite; Stability; Orbital mechanics; Magnetic force; Gravitational field

ICMA 124: Analyzing the Complex Dynamics of Julia Sets, Mandelbrot Sets and Biomorphs Using the WN-Iterative Scheme with Numerical Results

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Abstract: The iteration of complex-valued mappings can produce captivating fractal images. The dynamical behavior of most fractals relies on escape criteria, which are applied through diverse iterative procedures. This research introduces a novel iterative approach known as the WN-iterative method. Using this method, escape criteria are established for complex-valued mappings of the form

$$T_1(z) = z^p + bz + c, \quad T_2(z) = z^p + qz + \log(c^t), \quad T_3(z) = z^p + rz + \sin(c^t),$$

for all $z \in C$, where $p \in N \setminus \{1\}$, $t \in [1, \infty)$, and $b, r, q, c \in C$, with $c \neq 0$. Subsequently, algorithms are formulated and implemented for generating Julia sets, Mandelbrot sets, and Biomorphs. The symmetry of Julia sets is analyzed, and the compactness of the Mandelbrot set is established under specific conditions through analytical proofs. Finally, the impact of input parameters—such as shape, size, and color—on the generated fractals is examined through both graphical and numerical experiments.

Keywords: Julia sets; Mandelbrot sets; W-iteration; Escape criterion

ICMA 125: The Standard Model of High-Energy Physics: Mathematical Insights into Fundamental Particles and Forces

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Abstract: The Standard Model of high-energy physics is a crucial theoretical framework that describes the fundamental particles and their interactions through mathematical constructs. This research work focuses on the mathematical underpinnings of the Standard Model, including the application of group theory, gauge symmetries, and the role of Lie algebras in classifying particles and interactions. We examine how mathematical techniques such as Feynman diagrams facilitate the calculation of scattering amplitudes and predict outcomes of particle collisions. The discovery of the Higgs boson at the Large Hadron Collider serves as a case study, demonstrating the application of mathematical models to experimental validation. Additionally, the paper discusses the mathematical challenges that arise in the Standard Model, particularly concerning the unification of forces and the incorporation of gravity, which remains unresolved. These challenges inspire research into advanced mathematical frameworks, such as string theory and topological quantum field theory, aiming to extend our understanding beyond the Standard Model. Presenting these findings at a mathematics conference aims to foster interdisciplinary dialogue, highlighting the integral role of mathematics in shaping our understanding of fundamental physics.

Keywords: Standard model; Mathematical physics; Gauge symmetries; Higgs boson; Quantum field theory

ICMA 126: A Study on Rheological Models and Their Simulations in Various Geophysical Mass Flow Types

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Abstract: Exploring the diverse nature of geophysical flows and their rheological characteristics is truly intriguing. It involves examining how various natural flows such as debris flows, mudflows, and granular density currents respond under different conditions. The field of rheology, which focuses on the

movement and deformation of matter, is essential for predicting the behaviors of these flows. This paper aims to study the rheological properties of both Newtonian and non-Newtonian mass flow models. This study delves into mass flows including Bingham, Herschel-Bulkley, and quadratic or bilinear models within the realm of non-Newtonian fluids. It examines the relationships between shear stress and shear rate across various parametric scales. Additionally, it explores models such as Bagnold's grain inertia, Mohr-Coulomb plasticity, and μ(I)-rheology. The study also investigates simulations related to mixture bulk viscosity and the viscosity of mixtures containing solid particles, bubbles, or drops. Also, the newly developed rheological models in pressure and rate-dependent Coulomb-viscoplasticity and simulations of a mixture flow with a full-dimensional generalized quasi two-phase model are studied in details.

Keywords: Bulk viscosity; Yield stress; Viscoplasticity; Strain tate, Shear stress

ICMA 127: The Influence of the Physical Parameters on the Landslide Dynamics

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Abstract: Mass movement-induced natural disasters such as avalanches, debris flow, and rock slides are simply called landslides. In other words, heavy rainfall can saturate loose soil with water, weakening the cohesive force and causing it to flow downslope under the influence of pore pressure and gravity. These natural disasters may cause extensive human casualties, severe damage to civil infrastructure, and substantial economic loss. The study focuses on the one-dimensional two-phase mass flow model to study the influence of the physical parameters on the landslide dynamics. Performing the numerical solution by varying the particle concentration, and volume of the initial release mass, and also varying the mountain slope by using the existing two-phase mass flow model. Analyzing the physical parameters with the studying of the time evolution of landslide dynamics and comparing the obtained results with the help of a graph. Finally, some small laboratory experiments will be performed in the lab to validate the results. The proper analysis of such dynamics is useful for the possible mitigation measure of economic loss, human casualties, and the environment.

Keywords: Avalanche; Debris flow; Landslide dynamics; Two-phase mass flow; Particle concentration

ICMA 128: Threshold-Based Hash-Based Digital Signatures in Finite Fields for Distributed Quantum-Resistant Systems

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Abstract: With the rise of quantum computing, classical cryptographic systems face a great deal of security challenges. Therefore, this paper tries to improve security, efficiency, and fault tolerance in distributed quantum adversarial environments with a new threshold-based hash-based digital signature scheme using finite fields. The proposed scheme allows for secure, resilient digital signatures on resource-constrained platforms, including IoT and blockchain systems, while distributing cryptographic trust to several parties. The arithmetic of finite fields brings computational efficiency, reduces storage demands, and increases the signature verification speed—essential factors for applications demanding real-time processing and low power consumption. Security analyses expose the strength of the scheme when facing quantum attacks, and fault-tolerant tests verify its stable performance under partial system failure. These outcomes solidify the proposed scheme as a robust post-quantum cryptographic competitor well suited to secure multi-party system environments.

Keywords: Post-quantum cryptography; Hash-based digital signatures; Finite fields; Threshold cryptography; Distributed systems; Quantum-resistant security; IoT; Fault tolerance

ICMA 129: On Some Sequence Spaces of Bi-Complex Numbers

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Abstract: In 1892, Segre introduced the concept of bi-complex numbers. The main contribution in bi-complex analysis was the pioneering works in functional analysis. It is a new subject, not only relevant from a mathematical point of view but also with significant applications in physics and engineering. In this presentation, we shall give an overview of bi-complex numbers, the completeness of some sequence spaces of bi-complex numbers. Besides these, we also present their algebraic, topological, and geometric properties.

Keywords: Bi-complex numbers; Euclidean norm; Banach space; Convexity; Uniform convexity

ICMA 130: Quasiconformal Folding Methods in Holomorphic Dynamics

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Abstract: Various methods of constructing entire functions with wandering domains have been known, and among them, A. P. Singh used the method of complex approximation to prove the existence of two transcendental entire functions f and g and a domain U such that U lies in the periodic components of f and g but it lies in the wandering component of $f(g)$. C. J. Bishop used the method of quasiconformal folding to construct entire functions in the Eremenko-Lyubich class B with at least two oscillating wandering domains. N. Fagella et al. further proved that these transcendental entire functions have exactly two oscillating wandering domains and also generalized the result of A. P. Singh by proving the existence of two entire functions f and g in class B such that all the Fatou components of f and g are preperiodic, but the Fatou set of $f(g)$ has a wandering domain.

Keywords: Wandering domains; Fatou set; Entire functions; Quasiconformal folding

ICMA 131: Analysis of Blood Flow Through an Overlapping Mild Stenosis

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Abstract: Stenosis, the abnormal narrowing of arteries often caused by atheroma, significantly impacts cardiovascular function by restricting blood flow. The progression of stenosis, influenced by factors such as blood viscosity, shear stress, and artery curvature, can lead to severe complications including strokes and heart failure. While much research has focused on single symmetric and non-symmetric stenoses, overlapping stenoses pose unique challenges due to their irregular shapes and greater obstruction of blood flow. This study analytically investigates key hemodynamic parameters—velocity, pressure, and wall shear stress—within an overlapping stenotic region, treating blood as a non-Newtonian fluid. Drawing on prior research on non-Newtonian flows, curved arteries, and magnetic field effects, this work offers insights that may enhance diagnostic tools and therapeutic strategies for cardiovascular diseases.

Keywords: Mild stenosis; Viscosity coefficient; Velocity profile; Volumetric flow rate; Pressure drop; Shear stress; Overlapping model

ICMA 132: Study on Susceptible-Infected-Recovered-Removed Model with Fractional Order Using Residual Power Series Method

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Abstract: In the present study, we develop a classical and fractional-order SIRR* epidemic mathematical model with susceptible, infectious, recovery, and removal groups. The fractional-order derivative $\alpha \in (0, 1]$ is considered in the Caputo sense. The stability analysis and existence and uniqueness of the solution of the fractional SIRR* model is discussed. We apply the residual power series (RPS) method to solve the model, which gives semi-analytical solutions in the form of convergent power series. The convergence analysis of the RPS approach is also described. Further, the effects of fractional derivatives α and other model parameters on the proposed model's behavior are also discussed. Their effects on the model's behavior with respect to time are seen to be the essential features of this work.

Keywords: Caputo fractional derivative; Fractional power series; Fractional SIRR* model; and Residual power series method

ICMA 133: The Numerical Method Based on Neural Network Method for a Class of Steady-State Heat Conduction Inverse Problems on Annular Domains

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Abstract: This paper employs a method based on Physics-Informed Neural Networks (PINNs) to solve steady-state heat conduction sideways problems on annular domains. The method transforms the sideways problem into an optimization control problem by embedding the Poisson equation and its boundary conditions into the neural network's loss function. The L-BFGS optimization algorithm is then used to minimize the loss function for numerical solutions. Numerical experiments demonstrate that the PINNs method effectively solves such problems, showing superior stability, accuracy, and noise resistance.

Keywords: Physics-informed neural networks; Steady-state heat conduction; Sideways value problem; Numerical methods

ICMA 134: The Numerical Method Based on Neural Network Method for a Class of Three-Dimensional Steady-State Heat Conduction Problems with Side Boundary Conditions

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Abstract: This paper investigates the numerical solution method for a class of three-dimensional steady-state heat conduction problems with side boundary conditions. Based on Physics-Informed Neural Networks (PINN), the loss functions are constructed for solving this problem, and a corresponding solution algorithm is designed to solve the three-dimensional heat conduction equation with side boundary conditions. Numerical simulations are conducted, and the numerical examples verify the effectiveness and accuracy of the proposed method.

Keywords: Physics-informed neural networks; Three-dimensional steady-state heat conduction; Sideways problem

ICMA 135: Effect of Blood Flow through Mild Stenosed Artery with Effective Viscosity

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Abstract: Normal blood flow is disrupted by aortic stenosis, which raises risks and affects the cardiovascular system. This work analyzes blood viscosity from the central core line to the arterial wall in order to look at flow parameters in arteries with minor stenosis. In order to account for effective viscosity at radial distances, fluid dynamics in axisymmetric directions are analyzed using the Navier-Stokes equation. Additionally, analytical expressions for shear stress, pressure drop, velocity profile, and volumetric flow rate are investigated. These results contribute to our growing knowledge of vascular physiology in stenosis and emphasize the intricacy of blood flow.

Keywords: Arterial stenosis; Viscosity; Hematocrit; Hemodynamic parameters

ICMA 136: Modelling Infectious Diseases: Analysing the Impact of Control Measures

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Abstract: Infectious diseases have historically been a major public health concern worldwide. Mathematical models are effective tools for studying how these diseases spread, helping to identify the key factors influencing transmission. Current work analyzes a compartmental model with and without control measures. The associated basic reproduction numbers are computed, which are then used to explain the stability and existence of equilibrium points. A sensitivity analysis of the control efforts is performed, and graphical results are provided to support the mathematical findings.

Keywords: Infectious diseases; Compartmental models, Control measures; Basic reproduction number; stability; Sensitivity analyses

ICMA 137: Well-Posedness of Nonlinear SPDE Driven by Lévy Noise

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Abstract: In this article, we study a nonlinear stochastic control problem perturbed by multiplicative Lévy noise, where the nonlinear operator (in divergence form) satisfies p-type growth with coercivity assumptions. By using Aldous tightness criteria and Jakubowski's version of the Skorokhod theorem on non-metric spaces along with the standard L1-method, we establish the existence of a path-wise unique strong solution.

Keywords: Nonlinear stochastic PDE; Strong and martingale solution; Pseudo-monotone type SPDE; Jakubowski's version of Skorokhod theorem

ICMA 138: Some Properties of Vector-Valued Sequence Spaces and Extension to Bi-Complex Numbers

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Abstract: So far, a bulk number of generalizations have been done from scalar-valued sequence space to vector-valued sequence spaces. In 1892, Segre introduced the concept of bi-complex numbers, which have significant applications in physics and engineering. In this presentation, we shall give an overview of vector-valued sequence spaces and their extension to bi-complex numbers. Additionally, we present their algebraic, topological, and geometric properties.

Keywords: Sequence spaces; Vector-valued sequence space; Bi-complex numbers; Euclidean norm; Convexity

ICMA 139: Haskell Matrix Method in the Propagation of Love Waves in Multilayers of Magneto-Thermoelastic Materials

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Abstract: The problem of Love waves in multilayers of generalized magneto-thermoelastic materials has been investigated using the Haskell matrix method. The dispersion relations for the surface waves are derived for the topmost boundary surface with appropriate conditions. There are two wavefronts of Love-type surface waves: the first wavefront is due to the electromagnetic parameters, and the second wavefront appears due to the thermal parameters. The dispersion curves of both these fronts are computed for 2-layer and 3-layer models, and the results are represented graphically. The 3D pictures of displacement, conductive temperature, stress tensor, and heat flux are also plotted.

Keywords: Love wave; Generalized magneto-thermoelasticity; Haskell matrix method; dispersion relation

ICMA 140: Genetic and PSO Algorithm for Optimization of Artificial Neural Network Modeled Multivariate Function: An Application to Lactic Acid Production

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Abstract: In this study, an Artificial Neural Network (ANN) was implemented to model a relationship between factors affecting a process and its output, commonly known as multivariate functions. The Genetic Algorithm (GA) and Particle Swarm Optimization (PSO) were used as a metaheuristic approach to find the optimal values of the factors that maximize the output, where the ANN was used as the fitness function for the Genetic Algorithm. To validate the scheme, a few known multivariate functions are taken where the ANN model is employed to reconstruct the function, and the GA/PSO algorithm was applied to estimate its optimal value. Finally, the proposed approach is applied to estimate the optimal experimental conditions for the production of lactic acid.

Keywords: Genetic algorithm; PSO algorithm; Artificial neural network; Multivariate function; Optimization; Lactic acid

ICMA 141: Ethnomathematical Ideas in Tharu Women's Traditional Ornaments

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Abstract: Tharu are an indigenous people with a distinct culture and lifestyle. They use their mathematical concepts and thinking while they go about their everyday responsibilities. Ethnomathematics may serve as a connection between culture, technology, and the arts. Consequently, a study of mathematical values that converge with cultural anthropology should be thoroughly investigated. This study intends to reveal the secret ethnomathematical expertise and knowledge used in traditional ornament worn by Tharu women's in Nepal. This research employed an Embedded Mixed-Methods Design. Simultaneously, data gathering was executed through interviews, observations, and measurements of various traditional ornaments. Emic ethnomodeling is used to look at the mathematical ideas used in traditional ornament. The findings indicated that intricate mathematical ideas and concepts including the center, radius, diameter, circumference of a circle, symmetry, different geometric patterns, conic sections, permutation, and other sophisticated mathematical principles are demonstrated in traditional ornament worn by Tharu women's in Nepal.

Keywords: Ethnomathematics; Indigenous knowledge; Ornament; Conic section; Permutation

ICMA 142: Maximum Flow Transshipment over Networks

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Abstract: We consider maximum integral flow transshipment over a multi-network with a single source, a single sink, intermediate vertices with fixed storage capacity, arcs with fixed capacity and with asymmetric transit time on anti-parallel arcs. Mathematical models and algorithms in contraflow approach over such a network are presented.

Keywords: Network flow; Contraflow; Maximum flow

ICMA 143: On Lexicographic Network Flow Problems

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Abstract: One of the most thriving areas of mathematical optimization is network flow theory, which finds extensive use in a wide range of real-world issues. Efficiently moving flow units from one location to another across the available network is the main objective of a network flow problem. The lexicographic flow problem is one of the well-known network flow problems where capacitated vertices in the network are given priority and flow may not be conserved at intermediate vertices. In this paper, we discuss the lexicographic flow model and solution procedures of its different variants together with their applicability in real world problems.

Keywords: Optimization; Network flow; Lexicographically maximum flow; Intermediate vertices

ICMA 144: Effect of Timely Varying Curvature on Hemodynamics

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Abstract: The blood flow dynamics can be modeled by using Navier-Stokes equations and partial differential equations (PDEs). We will consider blood as a Newtonian fluid with steady and well-developed flow. Continuity and momentum balance of the Navier-Stokes equations in Cartesian form are used to calculate the flow parameters. We are trying to address the effect of timely varying curvature. The flow will be more complicated when the curvature varies with time. All the flow characteristics affected by curvature are to be calculated. We calculated the pressure, pressure drop, shear stress, maximum to minimum shear stress ratio, and pressure drop ratio with and without stenosis. We have focused our study on curvature developed in arteries during the time of blood flow.

Keywords: Curvature; Hemodynamics; Newtonian fluid; Steady state flow; Shear stress

ICMA 145: On Certain Difference Sequence Space using Orlicz Function

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Abstract: Lindenstrauss and Tzafriri used the idea of the Orlicz function and introduced the sequence space l^M in 1936, and the concept of difference sequences was introduced by H. Kizmaz in 1981. In 2008, Subramanian introduced difference sequence space $l^M(\Delta)$ defined by Orlicz function M. In this presentation, we shall explain some difference sequence spaces defined by Orlicz Function and establish some inclusion relations. Besides this, we shall also study the paranormed structure in this space.

Keywords: Difference sequence space; Orlicz function; Paranormed space; Banach space

ICMA 146: A Meshfree Arbitrary Eulerian-Lagrangian Method for Conservation Equations

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Abstract: Partial differential equations (PDEs) model various physical phenomena in fluid dynamics, structural mechanics, and electromagnetics. Over the years, both Eulerian and Lagrangian approaches have been used extensively for solving such equations. However, each has its limitations in dealing with large deformations and moving interfaces. Arbitrary Lagrangian-Eulerian (ALE) methods bridge the gap by allowing for a flexible computational mesh, combining the advantages of both Eulerian and Lagrangian frameworks. The Eulerian method fixes the computational grid in space, with the fluid or material moving through the grid. It is suitable for problems where the material undergoes significant deformation but poses difficulties in tracking interfaces or boundaries. The Lagrangian method, in contrast, moves the computational grid with the material, making it ideal for tracking interfaces but potentially leading to mesh distortion in the case of large deformations. ALE methods provide a hybrid approach that decouples mesh motion from material motion, improving computational efficiency and accuracy in dynamic systems.

Keywords: Meshfree methods; Eulerian-Lagrangian methods; Semi-Lagrangian method; Conservation equations

ICMA 147: Double Sequence Space of Fuzzy Real Numbers Defined by Orlicz Function

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Abstract: The theory of fuzzy logic and the fuzzy set has been successfully applied in various fields of research in social science, management science, and mathematics. In this work, we use the concept of fuzzy real numbers to introduce and study the new double sequence space defined by the Orlicz function and study some of their properties like linear space structure, completeness, and solidness.

Keywords: Fuzzy real numbers; Orlicz function; completeness

ICMA 148: Weakly Compatible Mappings of Type (P) in Menger Space

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Abstract: Austrian Mathematician Karl's Menger introduced Menger space, a probabilistic generalization of metric space in 1942. The study of this space connects the relation between non-linear analysis and probability. It expanded rapidly after the pioneering work of B. Schweizer and A. Sklar in 1960. The first contracting mapping in Menger space was introduced by V. M. Sehgal in 1966, and T. L. Hicks proposed a second contraction mapping in Menger space in 1983 for single self-mapping to establish fixed point theorems. S. N. Mishra introduced the idea of compatible mapping in Menger space to research the common fixed point theorem in more than one self-mapping in 1991. This talk aims to discuss weakly compatible mapping of type (P) in Menger space and the algorithm to find a common fixed point theorem in Menger space by using this compatible notion in four self-mappings.

Keywords: Probabilistic metric space; T-norm; Compatible mapping; Weakly compatible mapping

ICMA 149: Multiphase Mass Flows: Numerical Simulations and Laboratory Experiments

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Abstract: Gravitational mass flows like landslides, debris flows, and floods, as well as industrial mass flows, are composed of solid particles with different physical properties and viscous fluid. In these flows, interactions between fluid and particles play an important role in their transport and deposition. To model the dynamics of such flows and the complex interaction among the constituent phases, multiphase mass flow models with appropriate flow physics and rheology are required. We discuss leading multiphase mass flow models and the associated simulations related to debris mass flows and their interactions with different defense structures. We also present fully analytical physical-mathematical models we recently developed to describe the impact pressure coefficient, impact

velocity, and mobilization length when granular debris impacts structures. The models are validated through novel chute experiments with native Nepalese food grains and fruit seeds, conducted at the Laboratory Nepnova – Innovation Flows in Kathmandu. We discuss the application potential of the new models to environmental and industrial mass transports.

Keywords: Multiphase mass flow model; Debris flows; Flow-structure interaction; Impact pressure coefficient; Mobilization length

ICMA 150: Some Common Fixed Point Theorems in Dislocated Metric Space

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Abstract: The fixed point theory has played an important role in the problems of non-linear functional analysis, which is the blend of analysis, topology, and algebra. In 1922, Banach, S. proved a fixed point theorem for contraction mapping in metric space; since then, several fixed point theorems have been proved by different authors, and many generalizations of this notion have been established. In 1986, S. G. Matthews introduced some concepts of the dislocated metric in the context of metric domains. In 2000, P. Hitzler and A. K. Seda generalized the notion of topology and named dislocated topology. This paper aims to define a new property that generalizes the concept of noncompatible mappings and gives some common fixed-point theorems under strict contractive conditions using the (E. A.) and (CLR) properties.

Keywords: Dislocated metric space; Weakly compatible maps; (E.A) property; (C.L.R.) Property; Common fixed point

ICMA 151: A Closed Economy Model Analyzing the Impact of Exogenous Taxes on National Income and Interest Rate

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Abstract: An economic model with exogenous tax rate is put forward to understand the changes in income and interest rate using the fundamental concept of the IS-LM (Investment saving and liquidity preference money supply) model

in macroeconomics. The deterministic model (ODE system) is discretized into a discrete system using Euler's method. Equilibrium analysis and stability analysis of the discrete system are performed analytically to obtain the conditions for the feasibility and stability of non-negative equilibria. Numerical simulations are carried out to validate the analytical findings, taking small time spaces to resemble the discrete system to the ODE system. The numerical simulations of the model are plotted to visualize different dynamics using different parameter values. The findings underscore the critical role of parameter sensitivities in shaping economic stability and activity within this system.

Keywords: Stability,; discrete-time system; IS-LM model; Interest rate; Economic activity

ICMA 152: Maximal Monotone Operator and Its Application.

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Abstract: Our aim in this research is to study the basic concept of monotone and maximal monotone operators in Banach space. Here we make an attempt to describe the basic concept of the maximal monotone operator. We will discuss the application of maximal monotone operators to ordinary and partial differential equations.

Keywords: Monotonicity; Maximal monotonicity; Ordinary and partial differential equations

ICMA 153: On Network Interdiction Problems

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Abstract: Unwanted disturbance on the pre-scheduled flow-plan over the network is called network interdiction. A problem related to it is the network interdiction problem, which has a wide range of real-world applications, including transportation problems and logistics supply problems. In this paper, we discuss network interdiction problems with their models and solution algorithms. Moreover, we propose a model for the lexicographic maximum contraflow network interdiction problem and propose its solution algorithm.

Keywords: Network flow; Network interdiction; Contraflow; Lexicographic maximum flow

ICMA 154: Evacuation Strategies for Symmetric and Asymmetric Network Topology

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Abstract: Dynamic flow formulations are the basic mathematical tools for evacuation planning problems. It can be formulated to have the maximum flow and/or minimum time and/or minimum cost, depending on the nature and scenario of the problem. But for the evacuation system, the focus is to be on time minimization with maximum flow so that many evacuees can be evacuated in the minimum possible time. Their effectiveness on transit-based evacuation systems depends mainly on the network structures. In this research work, we consider the optimization strategies to have the minimum clearance time concerning the transit-based evacuation planning problems in a network with symmetric and asymmetric topology for urban areas.

Keywords: Evacuation; Integrated network; Transit-based system; Symmetric network; Asymmetric network

ICMA 155: On Network Facility Location Problems

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Abstract: The network flow problem is a modeling tool for many real-world scenarios, including facility location problems. The network facility location problem is to find locations within the network for new facilities such that the conveying cost from facilities to customers is minimized. The problem has been extensively studied with its variants in the literature. In this paper, we discuss the various models on facility location problem with their solution algorithms.

Keywords: Network flow; Facility location problem; Optimality

ICMA 156: Meshfree Semi-Lagrangian Method for Solving Burgers' Equation

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Abstract: Partial differential equations are essential in fluid dynamics and wave theory, with the inviscid Burgers' equation serving as a fundamental model for studying nonlinear propagation and shock formation. This study focuses on solving the inviscid Burgers' equation using a meshfree semi-Lagrangian method to benchmark the numerical solution against its analytical counterpart. Key meshfree methods, including least squares and radial basis functions, are applied and compared to evaluate solution efficacy. Various initial and boundary conditions are considered to rigorously compare numerical and analytical solutions, with a focus on the effectiveness of the meshfree semi-Lagrangian approach.

Keywords: Meshfree methods; Semi-Lagrangian method; Burgers' equation; partial differential equations; Benchmark; Efficacy

ICMA 157: Budget-Constrained Facility Allocation Optimization in Evacuation Network

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Abstract: Decision-making and analysis have been essential components of management science since the dawn of civilization. To effectively address real-world problems, decision-makers must consider multiple objectives and factors, and the problems must be transformed into multi-criteria decision-making problems. This requires a comprehensive understanding of the problem and the ability to consider different criteria to make the best decision possible. This research combines network facility location and contraflow with switching cost approaches to solve evacuation network problems more efficiently. The FlowLoc problem seeks to allocate facilities in the network with minimum flow loss. At the same time, the contraflow approach is widely accepted in evacuation planning to increase the outbound capacities of roads. Additionally, budget constraints are considered to ensure that resources are not exceeded. By combining these approaches, this research seeks to provide more effective solutions in management sciences.

Keywords: Evacuation network; Abstract flow; Facility location; FlowLoc problem; Contraflow

ICMA 158: Optimizing Dengue Outbreak Predictions Using Fuzzy Logic

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Abstract: Dengue outbreaks pose significant public health challenges due to their unpredictability and complex contributing factors, such as climate, population density, and vector dynamics. Fuzzy logic, a computational approach capable of handling uncertainty and imprecision, has emerged as a promising tool for predicting dengue outbreaks. This study explores the application of fuzzy systems to model relationships among diverse factors like temperature, rainfall, humidity, and case trends. By integrating fuzzy rule-based reasoning with epidemiological data, the proposed approach identifies patterns and thresholds that are crucial for early outbreak detection. The system's adaptability to varying conditions enhances its predictive accuracy, offering valuable insights for public health planning and vector control strategies. This analysis underscores the potential of fuzzy logic in mitigating the impact of dengue by supporting timely interventions and resource allocation.

Keywords: Fuzzy logic; Predictive modeling; Dengue outbreak

ICMA 159: Quantum and LCD Codes from Skew Constacyclic Codes over a General Class of Non-chain Rings

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Abstract: In this paper, we study skew constacyclic codes over a class of non-chain rings $\mathcal{T} = F_q[u_1, u_2, \ldots, u_r]/\langle f_i(u_i), u_iu_j - u_ju_i\rangle_{i,j=1}^{r}$, where $q = p^m$, p is some odd prime, m is a positive integer, and $f_i(u_i), 1 \leq i \leq r$, are non-constant, monic polynomials that split into distinct linear factors. We discuss the structural properties of skew constacyclic codes over $\mathcal{T}$ and their dual. We characterize Euclidean and Hermitian dual-containing skew constacyclic codes. These characterizations serve as a foundational framework for the development of techniques to construct quantum codes. Consequently, we derive plenty of new quantum codes including many Maximum Distance Separable (MDS) quantum codes, and many quantum codes with better parameters than existing ones. Our work further extends to the characterization of skew constacyclic Euclidean and Hermitian Linear Complementary Dual (LCD) codes over $\mathcal{T}$, and we establish

that their Gray images also preserve the LCD property. From this analysis, we derive numerous Maximum Distance Separable (MDS) codes and Best Known Linear Codes (BKLC) over F_q.

Keywords: Skew constacyclic codes; Quantum codes; LCD codes

ICMA 160: Maximum Flow Location Modeling without Restrictions on Facility Sizes

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Abstract: Network flow location modeling deals with the identification of optimal facility locations on the arcs of networks to optimize the flow after the capacity reductions due to facility assignments. The modeling is particularly useful when facilities are to be placed in the road segments, resulting in a reduction in the flow values and an increase in the time or cost of the flow. FlowLoc models deal with such a situation where a set of facilities with given sizes (capacities) must be allocated to a given set of arcs in a directed network. The existing models assume that the size of each facility does not exceed the capacity of each of the arcs in the given set and that the number of given facilities does not exceed the number of available locations on arcs, without considering the cost of the flow. This work extends the FlowLoc modeling, where facilities can have arbitrary sizes and numbers. Mixed-integer programming models are constructed based on static and dynamic network flow modeling. For static/dynamic flow location modeling, multiple facility cases are considered. Realizing the NP-hardness of the problems, polynomial-time heuristic algorithms are designed to solve the constructed models.

Keywords: FlowLoc; Heuristics; Facility location, Network flow

ICMA 161: Experimental Analysis of Mixture Mass Flows with Coupling

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Abstract: This study presents the development and experimental analysis of coupled model equations for mixture mass flows, derived from two-dimensional and depth-averaged formulations of the governing equations. The model is designed to address flow scenarios ranging from smooth paths to cases where obstacles interrupt flow continuity. The coupled model employs non-linear partial

differential equations, incorporating numerical decomposition techniques to integrate depth-averaged and two-dimensional frameworks for a comprehensive representation of flow dynamics.

The experimental analysis explores the interactions between solid, liquid, and gas phases in mixture mass flows, focusing on natural phenomena such as debris flows, sediment transport, and industrial processes involving slurry flows. In laboratory experiments, mixtures of Nepali supergrains representing two types of granular masses are utilized to study flow behaviors. Advanced imaging and sensor technologies are employed to monitor key flow parameters, including velocity, phase distribution, and stress fields.

The findings reveal critical factors influencing flow stability, transitional regimes, and energy dissipation, providing significant insights into the predictive accuracy and practical applicability of the model. The results hold considerable implications for enhancing the safety and efficiency of multi-phase flow systems and developing strategies for hazard mitigation in geophysical contexts.

Keywords: Non-linear partial differential equations; Coupled model; Experimental analysis; Multi-phase flows

ICMA 162: On the Sum of Maximal Monotone Operators

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Abstract: Certain geometric properties of Banach spaces are characterized by analytic properties of their duality mappings. The duality mappings are also used in the theory of maximal monotone operators on Banach spaces. The sum of two monotone operators is always monotone; however, the sum of two maximal monotone operators is not necessarily maximal monotone. We present certain cases in which the sum of two maximal monotone operators is maximal monotone. The first result in this area is by Rockfeller that at least one of A and B has a domain with nonempty interior. Here we take the case of Heisler that shows the maximality of the sum of two maximal operators A and B under some additional hypothesis that the domains are the entire Banach space.

Keywords: Duality mappings; Maximal monotone operators

ICMA 163: Redefining Human Development Measurement: A Multi-Dimensional Model for Grassroots Assessment

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Abstract: The definition of human development has evolved since 1990, shifting towards a focus on human welfare and freedom, with key factors such as health, education, and income. A major challenge is creating an effective model to measure human development, particularly at the grassroots level. This research aims to develop a more accurate and rational model by linking human development to the Sustainable Development Goals (SDGs), using a statistical approach based on principal component analysis (PCA).

The study critiques existing models, which often assign equal weights to health, education, and income, without considering their relative importance in the current development context. It proposes including additional factors such as social governance and technological adoption. These factors, along with adjusted weights, improve the model's ability to measure human development more effectively. The model uses multiple regression analysis (MRA) to refine its accuracy and reflective capacity. The proposed equation for measuring human development is:

$$Y = \alpha + 0.14(X_1) + 0.16(X_2) + 0.19(X_3) + 0.23(X_4) + 0.28(X_5)$$

Where: α = Life expectancy (dependent on the region) X_1 = Resource use index X_2 = Education X_3 = Income X_4 = Social governance X_5 = Technological adoption . The model normalizes these components to provide a more scientifically grounded approach to measuring human development at the grassroots level. By incorporating SDG factors and rational weights, it offers a more comprehensive framework for assessing human development in various regions.

Keywords: Human development; Sustainable development gals; Weight; Components; multiple regression analysis

ICMA 164: Effect of Thickness of the Stenosis: Two-Layer Model

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Abstract: The continuous growth of stenosis within an artery significantly impacts hemodynamic parameters, disrupting normal blood flow and leading to adverse physiological effects. This study investigates the influence of time-dependent increasing stenosis on blood flow dynamics using the Navier-Stokes equations in cylindrical polar coordinates, considering blood as a non-Newtonian fluid. A novel two-layered model is proposed by incorporating a temporal term to represent the evolving stenosis. Analytical solutions for flow parameters are derived under appropriate boundary conditions, and the results are analyzed and compared with viscosity.

The findings indicate that increasing stenosis thickness over time exacerbates flow disturbances, with significant implications for the core and peripheral regions of the artery. This model offers insights into the complex interplay between stenosis progression and hemodynamic factors and serves as a valuable tool for researchers exploring cardiovascular flow dynamics.

Keywords: Increasing stenosis; Radius reducing factor; Aortic Stenosis; Core layer; Temporal term

ICMA 165: Dynamic Analysis of Mixture Mass Flow in Nepalese Supergrains

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Abstract: Geophysical mass flows, such as landslides, debris flows, and rock avalanches, represent significant natural hazards. This study explores the mechanics of mass flows through the lens of mathematical modeling, employing partial differential equations to describe their behavior. Specifically, we introduce a model for mixture mass flows, providing experimental results that reveal the dynamics of these flows and the morphology of their deposition in the run-out zone.

Our experimental setup utilizes a mixture of Nepalese supergrains—Hogplum seeds (Champati) and Horse Gram (Gahat). Despite their material properties, the mixture demonstrates unique mechanical behavior. Through a detailed analysis of these flows, we elucidate key dynamic properties and offer insights into their behavior. This research contributes to the broader understanding of geophysical mass flows, with implications for hazard assessment and mitigation strategies.

Keywords: Mixture mass flows; Partial differential equations; Mechanical behaviour; Material properties; Nepalese supergrains

ICMA 166: Simple Waves in Two-Dimensional Magnetohydrodynamics for Anti-Van Der Waals Modified Chaplygin Gas

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Abstract: This study investigates the existence of simple waves in a two-dimensional magnetohydrodynamics (MHD) system for anti-van der Waals-modified Chaplygin gas. Utilizing characteristic decomposition, the analysis establishes the presence of simple waves in both steady and pseudo-steady cases. The results are extended to a full MHD system, assuming isentropic and irrotational flow conditions. We demonstrate the transition between hyperbolic and elliptic regimes by examining the eigenvalue structure. This framework provides a deeper understanding of the wave structures in MHD systems influenced by non-ideal gas dynamics, revealing significant theoretical and computational fluid dynamics applications.

Keywords: Simple waves; Magnetohydrodynamics; Anti-van der Waals gas; Modified Chaplygin gas; Characteristic decomposition

ICMA 167: Some Generalizations of Orthogonality in Terms of Bounded Linear Operators

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Abstract: This paper deals with a generalization of orthogonality in terms of bounded linear operators on the Banach space. The goal is to find the relation between orthogonality of images and elements. We prove that if the images of bounded linear operator are orthogonal in the Pythagorean sense, then the elements are orthogonal in the sense of Birkhoff's definition. In the case of Robert's orthogonality under the restriction that any elements belonging to intersection of the norm attainment set of $T_1 + \mu T_2$ and $T_1 - \mu T_2$, if the images are orthogonal, then it implies that the operators are also orthogonal. Furthermore, some results in relation to the Carlsson, isosceles, and the approximate Birkhoff-James orthogonality have been studied.

Keywords: Banach space; Isosceles orthogonality; Birkhoff-James orthogonality; Pythagorean orthogonality

ICMA 168: Vedic Sutra: Urdhav Tiryagbhyam

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Abstract:

This paper specially concentrate only on the general pattern of multiplication by Vedic methods which is applicable in all the cases of all types of numbers, which is known as Sutra. The meaning of Urdhav Tiryagbhyam is "Vertically and crosswise". The specific are those which are fast and effective but can be applied only to a particular case. In this system, for any problem, there is always one general technique applicable to all cases and also to number of special pattern problems. The methods discussed, and organization of the content of the paper here are intended to show the Vedic Mathematics is an extremely refined and efficient mathematical system.

Keywords: Vedic mathematics; Urdhav tiryagbhyam; Dot and Stick; Bijak nawshesh

ICMA 169: Hausdorff and Dunkl-Hausdorff Operators on Function Spaces

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Abstract: In this talk, we shall discuss the weighted L^p-boundedness of the Hausdorff operator:

$$(H_\phi f)(x) := \int_0^\infty \frac{\phi(y)}{y} f\left(\frac{x}{y}\right) dy.$$

As an application of Sawyer's duality principle, the corresponding boundedness for monotone functions will be derived. Also, we shall discuss the operator H_ϕ in the framework of grand Lebesgue spaces. We shall point out the possibility of dealing with the more general Dunkl-Hausdorff operator:

$$(H_{\alpha,\phi} f)(x) := \int_0^\infty \frac{\phi(y)}{y^{2\alpha+2}} f\left(\frac{x}{y}\right) dy.$$

Keywords: Hausdorff operator; Dunkl-hausdorff operator; Weighted L^p spaces; Grand Lebesgue spaces

ICMA 170: Modular Method for Parametrization of Rational Normal Curves

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Abstract: Building on the massively parallel methods described in [1] and the algorithms in [2], this talk presents a novel approach to parametrizing rational normal curves (RNC) using massively parallel techniques. We introduce a modular strategy for constructing free resolutions, where only the final syzygy matrix is lifted. This reduces the computational overhead typically incurred when lifting all such matrices. The final syzygy matrix is then used to efficiently parametrize the RNC. By modularizing the process, we demonstrate how classical algebraic geometry methods can be adapted to parallelized workflows, enabling faster and more efficient computations for complex geometric structures. Our implementation leverages the **GPI-Space** framework, a task-based workflow system that uses Petri nets for parallel workflow coordination, alongside the computer algebra system.

Keywords: Rational normal curves; Parallel algorithms; Syzygy matrices; GPI-space

ICMA 171: Optimal Control Analysis of Dengue Disease Transmission Dynamic in Nepal

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Abstract: An infectious disease called dengue is an increasing health concern nowadays. The dengue outbreak occurred with a single serotype all over Nepal in 2023. In underdeveloped nations like Nepal, the execution of adequate control measures is the most critical aspect in avoiding and controlling the development of dengue infection. The Caputo fractional dengue model with optimum control variables, including mosquito repellent and insecticide use, analyzes the influence of alternative control measures to reduce dengue prevalence. The model is simulated using a two-step Lagrange interpolation methodology, and the least squares method is utilized to estimate parameter values using real monthly infection data. The Pontryagin Maximum Principle is used to calculate the optimal control variable in the dengue model for control techniques. The present analysis reveals that the deployment of control measures is highly beneficial in lowering dengue incidence cases.

Keywords: Dengue fractional-order model; Basic reproduction number; Control measure; Parameter estimation; Numerical results

ICMA 172: Modeling Malaria Transmission with Relapse Delay: Impact on Elimination Plan of Low Endemic Countries

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Abstract: Malaria remains a global health challenge. Although the vivax malaria-infected humans recovered after clearance of blood-stage malaria parasites, there is a high potential for reinfection due to the reactivation of dormant hypnozoites in the liver, even in the absence of mosquito bites. Therefore, achieving the goal of malaria elimination is becoming critical in many countries, including Nepal. Here we develop, for the first time, a malaria model that includes relapse delay. Results from thorough mathematical analyses and numerical simulations using malaria parameters from Nepal show that the relapse proportion and relapse delay can play a significant role in malaria dynamics; specifically, increasing relapse delay extends the time to achieve malaria-free equilibrium when $R_0 < 1$, however, it converges fast to endemic equilibrium when $R_0 > 1$. Our model and the related results provide new insights and may help develop strategies to eliminate malaria, including in Nepal.

Keywords: Delay differential equations; Malaria relapse; Mathematical model; Hopf bifurcation

ICMA 173: Ferrofluid-Based Tilted Deformable Rough Porous Pad Bearing

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Abstract: This paper presents an innovative mathematical model to analyze the impact of slip and transverse roughness on a hydromagnetic squeeze film in a porous, tilted pad bearing. The stochastic model of Christensen and Tonder is used to account for surface roughness, while the Beavers and Joseph slip model addresses the slip effect. These models, which govern fluid pressure, are solved to calculate the load support. A closed-form solution is derived for both pressure and load capacity as functions of various physical parameters. The effects of these parameters are discussed with the help of graphical representations. The results show that minimizing slip is crucial for improving bearing design. Additionally, even in the absence of fluid flow, the bearing can still support a substantial load, unlike traditional lubricants.

Keywords: Tilted pad; Porosity; Ferrofluid; Roughness; Slip velocity; Load support

ICMA 174: Teachers' Perceptions and Practices of Digital Technology for Promoting Equity in Mathematics Classroom

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Abstract: The integration of digital technology in education has the potential to enhance learning experiences and promote equity, especially in mathematics classrooms. This study examines the perceptions and practices of teachers regarding digital technology's role in fostering equity in mathematics education, with a focus on Tribhuvan University's Central Department of Mathematics Education. Employing a qualitative case study approach, data were collected through classroom observations, unstructured interviews, and focus group discussions. Findings reveal that teachers generally perceive digital technology as a beneficial tool for promoting inclusivity and enhancing learning outcomes. They recognize its potential to support differentiated instruction, engage students through interactive simulations, and address diverse learning needs. However, challenges such as limited access to resources, inadequate training, and disparities in students' access to technology outside the classroom hinder its effective utilization. Classroom observations highlighted the role of teachers in creatively leveraging digital tools to foster equitable learning environments. The study concludes that while digital technology holds promise for advancing equity in mathematics education, its success largely depends on teachers' skills, perceptions, and strategic implementation. Addressing barriers like resource constraints and training deficiencies is essential to maximizing its impact. These findings contribute to developing strategies for more equitable and effective integration of digital technology in mathematics classrooms.

Keywords: Digital technology; Equity in education; Mathematics classrooms; Teachers' perceptions and practices

ICMA 175: Modeling COVID-19 Transmission in Nepal Using the SEIQR Framework

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Abstract: Mathematical modeling is a key approach for understanding the transmission dynamics of infectious diseases and developing effective control strategies. This study introduces an SEIQR model, which incorporates quarantine measures, to analyze the spread of COVID-19 in Nepal. The basic reproduction number is calculated using the next-generation matrix method, and the

model's equilibrium points are determined. The stability of these equilibria is assessed using the basic reproduction number. Sensitivity analysis is conducted to identify the most influential parameters on disease transmission. Numerical simulations are performed to visualize the mathematical findings.

Keywords: Compartmental model; COVID-19; Basic reproduction number; Equilibrium points; Stability analysis; Sensitivity analysis

ICMA 176: Qualitative Analysis of the Soliton Solutions to the Time-Fractional Generalized Kadomtsev-Petviashvili Model

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Abstract: The generalized Kadomtsev-Petviashvili (gKP) equation extends the Kadomtsev-Petviashvili (KP) equation by incorporating different forms of nonlinearity, broadening its applicability to various fields including nonlinear optics, fluid dynamics, geophysics, and plasma physics. The objective of this research is to investigate viable soliton solutions to the fractional-order model of the specified equation using the -expansion method. Through analysis and meticulous identification, diverse radical solutions, incorporating rational, hyperbolic, and trigonometric forms of the framework are created, and notable solitons are recovered by assigning suitable parameter values in the derived analytical solutions. The formed solitons display a variety of geometries, including kink-shaped, bell-shaped, V-shaped, periodic, singular periodic, and several more forms. The 3D and contour diagrams have been embellished for validating the physical features of these soliton solutions, while the 2D plots examine the effects of variations in the time parameter. The study presents new discoveries on soliton solutions for the specified equation, offering novel insights and emphasizing previously neglected features of this intriguing mathematical problem. The research further illustrates the efficacy and dependability of the deployed strategy.

Keywords: Generalized Kadomtsev-Petviashvili equation; Beta fractional derivative; Traveling wave solutions; Soliton solutions

ICMA 177: Development of Some Common Fixed Point Theorems in Semi-metric Space Using various contractive condition

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Abstract: This paper presents study on common fixed point theorems in semi-metric space. The author investigates the existence of some common fixed point theorems for two and three pairs of self-mappings under strict contractive conditions. Various types of contractions are employed to establish the result ensuring the applicability of the theorems in broad context. The finding contributes the development of fixed point theorems in semi-metric space.

Keywords: Semi-metric space; Fixed point; Contractive Condition; Self-mapping

ICMA 178: Estimating Pandemic Risks: Insights from Nepal's COVID-19 Response

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Abstract: The emergence of pandemic diseases poses significant challenges to global health systems, particularly in low- and middle-income countries such as Nepal. In this presentation, I will discuss models developed to estimate the risk of infection and hospitalization during pandemics, which are essential for effective resource allocation and health policy planning. This study utilizes a unique dataset from Nepal to analyze national and provincial-level risks during the Delta and Omicron surges. Additionally, our models evaluate the effectiveness of non-pharmaceutical interventions (NPIs) in mitigating the impact of COVID-19 across various demographic groups.

Keywords: Pandemic; COVID-19; Risk estimation

ICMA 179: Thermo-Mechanical State of Rock-Ice Avalanche: Analytical Solution

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Abstract: The rapid melting of glaciers and thawing permafrost in mountainous regions has intensified the risk of rock-ice avalanches, which can transform into hazardous water-saturated debris flows. This research introduces an innovative multi-phase thermo-mechanical model to address this issue, extending beyond traditional two-phase frameworks to incorporate interactions among rock, ice, and fluid. The model features a newly derived temperature equation

that accounts for heat advection, diffusion, internal heat exchange, basal heat conduction, and the impacts of frictional shearing and temperature changes. It emphasizes the role of lateral heat production and the significant effects of rapid ice melting. This comprehensive approach aims to enhance simulations of rock-ice avalanches, providing improved risk assessment and practical solutions for mitigating their impacts on communities and infrastructure.

Keywords: Advection; Diffusion; Rock-Ice Avalanche; Simulation

ICMA 180: Construction of Almost Unbiased Estimator for Parameter β Using Auxiliary Information Under Simple Random Sampling

Rajesh Singh[1], Sunil Kumar Yadav[1, *]

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Abstract: The present study focusses on estimating the regression coefficient β in a finite population using a simple random sampling procedure, in which every member of the population has an equal chance of being selected. In this paper, we have proposed an almost unbiased estimator in case of regression coefficients i.e. β . For this, we have taken the β as usual estimator suggested by Srivastava et al.(1986) and two others estimators which are suggested by Sukminder and Sarjinder(1988).

For the validation of theoretical result, we have used two data sets and one simulation study. The estimators' performance has been verified by applying the percent relative efficiency (PRE) and mean squared error (MSE) criteria. Results show that, in comparison to the other estimators, the proposed class of estimators shows more efficiency and is almost unbiased up to the first order of approximation.

Keywords: Finite population; Regression coefficient; Unbiased estimators; Mean square error; Percent relative efficiency

Program and Schedule

Venue: Hotel Ryne (Upcoming Best Western Plus)
Location map: https://maps.app.goo.gl/aXNkc6FA9sCnNVx8A

03:00 pm - 07:00 pm ***Registration*** Thursday, December 12, 2024

Program: Day-1 Friday, December 13, 2024

07:00 am - 08:30 am ***Breakfast / Registration***

08:30 am - 09:00 am **Inaugural Session (Annapurna Hall)**

Chair: **Prof. Dr. Narayan Prasad Pahari**, President, Nepal Mathematical Society

MC: **Dr. Jeevan Kafle**, Convener, ICMA-2024	
Welcome Speech: **Prof. Dr. Chet Raj Bhatta**, Head, Central Department of Mathematics, Tribhuvan University	[5 minutes]
Remarks by Convener: **Prof. Dr. Dinesh Panthi**, Convener, ICMA-2024	[5 minutes]
Remarks by Chief Guest: **Prof. Dr. Kedar Prasad Rijal**, Registrar, Tribhuvan University	[8 minutes]
Concluding Remark: **Prof. Dr. Narayan Prasad Pahari**, President, Nepal Mathematical Society	[5 minutes]

09:00 am - 09:30 am **Plenary Talk-1 (Chair: Prof. Dr. Dil B. Gurung) (Annapurna Hall)**
Prof. Dr. V. P. Saxena (Abs-1)

09:30 am - 10:20 am ***Tea Break***

Parallel Sessions:

10:20 am - 12:00 pm	**Session-1 (Annapurna Hall)** **Chair:** Dr. Puskar R. Pokhrel **Technical Support:** Bal B Tamang	**Session-2 (Sagarmatha Hall)** **Chair:** Dr. Hari Nandan Nath **Technical Support:** Eeshwar Prasad Poudel	**Session-3 (Board Room)** **Chair:** Dr. Kamalesh Kumar Lal Karn **Technical Support:** Thaneshor Bhandari
10:20 am - 10:35 am	Puskar R. Pokhrel (Abs-161)	Hari Nandan Nath (Abs-160)	Kamalesh Kumar Lal Karn (Abs-158)
10:35 am - 10:50 am	Dimplekumar Chalishajar (Abs-6)	Daniel Oluwasegun Adams (Abs-7)	Falalu Muhammad (Abs-25)
10:50 am - 11:05 am	Rajeev Misra (Abs-116)	Rakesh Kumar Meena (Abs-132)	Dingding Yan (133)
11:05 am - 11:20 am	Kuncham Syam Prasad (Abs-23)	Pallavi P. Kuncham (Abs-24)	Enyinnaya Ekuma-Okereke (Abs-27)
11:20 am - 11:30 am	Md. Amirul Islam (Abs-55)	Eeshwar Prasad Poudel (Abs-47)	Thaneshor Bhandari (Abs-57)
11:30 am - 11:40 am	Bal B Tamang (Abs-68)	Ajay Kumar (Abs-88)	Arjun Kumar Gaire (Abs-89)
11:40 am - 11:50 am	Maheshwor Pokhrel (113)	Jagat Krishna Pokharel (Abs-118)	Dal Bahadur Saud (Abs-119)
11:50 am - 12:00 pm	Qiong Zou (Abs-134)	Rakesh M. Patel (Abs-172)	Bishnu Bahadur Badaila (Abs-174)

12:00 pm - 01:00 pm ***Lunch Break***

01:00 pm - 03:00 pm	**Session-4 (Annapurna Hall)** **Chair:** Dr. Sushil Chandra Karna **Technical Support:** Dilip Kumar Sah	**Session-5 (Sagarmatha Hall)** **Chair:** Dr. Phanindra Prasad Bhandari **Technical Support:** Harish Chandra Bhandari	**Session-6 (Board Room)** **Chair:** Dr. Hem Raj Pandey **Technical Support:** Sachin Wagle
01:00 pm - 01:15 pm	Sushil Chandra Karna (Abs-123)	Phanindra Prasad Bhandari (Abs-43)	Hem Raj Pandey (Abs-171)
01:15 pm - 01:30 pm	Bhuwan Prasad Ojha (Abs-167)	Gyan Prasad Paudel (Abs-147)	Salah Uddin Mohammad (Abs-39)
01:30 pm - 01:45 pm	R. Kavin (Abs-137)	Saoudi Khaled (Abs-38)	Pradeep Rai (Abs-159)
01:45 pm - 02:00 pm	Padam Sharma (Abs-29)	S. Sarat Singh (Abs-139)	Aishwarya S (Abs-31)
02:00 pm - 02:10 pm	Dilip Kumar Sah (Abs-60)	Poonam Singh (Abs-30)	Nandu Prasad Koiri (Abs-62)
02:10 pm - 02:20 pm	Bekha Ratna Dangol (Abs-90)	Harish Chandra Bhandari (Abs-61)	Purushottam Parajuli (Abs-92)
02:20 pm - 02:30 pm	P. K. Sah (Abs-120)	Janak Prasad Neupane (Abs-91)	Sachin Wagle (Abs-122)
02:30 pm - 02:40 pm	Abhishek Singh (Abs-115)	Anup Tuladhar (Abs-121)	Gaurav (Abs-166)

02:40 pm - 03:30 pm ***Tea Break***

03:30 pm - 05:30 pm	**Session-7 (Annapurna Hall)** **Chair:** Dr. Ganga Ram Phaijoo **Technical Support:** Raj Kumar Pradhan	**Session-8 (Sagarmatha Hall)** **Chair:** Prof. Dr. Pankaj Jain **Technical Support:** Jayadev Nath	**Session-9 (Board Room)** **Chair:** Dr. Krishna Kanta Parajuli **Technical Support:** Uday Kumar Karna
03:30 pm - 03:45 pm	Ganga Ram Phaijoo (Abs-136)	Pankaj Jain (Abs-169)	Krishna Kanta Parajuli (Abs-168)
03:45 pm - 04:00 pm	Vaclav Macha (Abs-41)	Enyinnaya Ekuma-Okereke (Abs-26)	K. Somaiah (Abs-53)
04:00 pm - 04:15 pm	Raj Kumar Pradhan (Abs-94)	Md Rashed Talukder (Abs-50)	Olanegan O. O. (Abs-9)
04:15 pm - 04:30 pm	Brayan F. Bullang (Abs-30)	Avinash Kumar (Abs-8)	Ajmeera Chandulal (Abs-32)
04:30 pm - 04:40 pm	Bharat Bahadur Thapa (Abs-63)	Sandeep Singh (Abs-31)	Uday Kumar Karna (Abs-67)
04:40 pm - 04:50 pm	Avinash Chandra (Abs-54)	Jayadev Nath (Abs-65)	Giri Raj Paneru (Abs-96)
04:50 pm - 05:00 pm		Rajendra Paudyal (Abs-143)	Gunakhar Pokharel (Abs-59)

Program: Day-2 Saturday, December 14, 2024

05:30 am - 07:45 am **Excursion [Pasupatinath Temple + Shleshmantak Forest]**

07:45 am - 09:00 am ***Breakfast***

09:00 am - 09:30 am **Plenary Talk-2 (Chair: Prof. Dr. Jivandhar Jnawali) (Annapurna Hall)**
Prof. Dr. Andrea Braides (Abs-2)

09:30 am - 10:00 am **Plenary Talk-3 (Chair: Associate Prof. Dhana Kumari Thapa) (Annapurna Hall)**
Prof. Dr. Neela Nataraj (Abs-4)

10:00 am - 10:30 am ***Tea Break***

10:30 am - 12:00 pm	**Session-10 (Annapurna Hall)** **Chair:** Dr. Parameshwari Kattel **Technical Support:** Ganga Ram DC	**Session-11 (Sagarmatha Hall)** **Chair:** Dr. K.B. Manandhar **Technical Support:** Ganesh Bahadur Basnet	**Session-12 (Board Room)** **Chair:** Dr. Khagendra Adhikari **Technical Support:** Parshuram Chaudhary
10:30 am - 10:45 am	Parameshwari Kattel (Abs-149)	K.B. Manandhar (Abs-104)	Khagendra Adhikari (Abs-178)
10:45 am - 11:00 am	Diddi Kumara Swamy (Abs-64)	Sanjay Kumar (Abs-69)	Saikh Shahjahan Miah (Abs-73)
11:00 am - 11:15 am	Peter Pflaumer (Abs-10)	Ashish (Abs-11)	Vijay Kumar Bhat (Abs-13)
11:15 am - 11:30 am	Prayas Sharma (Abs-35)	Sajal Halder (Abs-36)	Ananta Upreti (Abs-37)
11:30 am - 11:40 am	Ganga Ram DC (Abs-70)	Mohammad Mokaddes Ali (Abs-77)	Vishalkumar J. Prajapati (Abs-78)
11:40 am - 11:50 am	Madhav Prasad Poudel (Abs-101)	Ganesh Bahadur Basnet (102)	Parshuram Chaudhary (Abs-141)
11:50 am - 12:00 am	Tara Bahadur Rana (Abs-22)	Molhu Prasad Jaiswal (Abs-138)	Bishnu Prasad Chapagai (Abs-153)

12:00 pm - 01:00 pm Lunch

01:00 pm - 03:00 pm	**Session-13 (Annapurna Hall)** **Chair:** Dr. Kedar Nepal **Technical Support:** Mr. Bekha Ratna Dangol	**Session-14 (Sagarmatha Hall)** **Chair:** Dr. Ajay Kumar Chaudhary **Technical Support:** Ritu Basnet Thapa	**Session-15 (Board Room)** **Chair:** Dr. Shree Ram Khadka **Technical Support:** Resham Prasad Paudel
01:00 pm - 01:15 pm	Kedar Nepal (Abs 28)	Ajay Kumar Chaudhary (Abs-148)	Shree Ram Khadka (Abs-142)
01:15 pm - 01:30 pm	Tangwei Liu (Abs-76)	Achaku D. T. (Abs-15)	A. K. Malik (Abs-16)
01:30 pm - 01:45 pm	Raghujyoti Kundu (Abs-14)	Syeda Darakhshan Jabeen (Abs-42)	Nitu Kumari (Abs-44)
01:45 pm - 01:00 pm	Y. N. Reddy (Abs-40)	Sunil Kumar Yadav (Abs-180)	Dibakar Raj Pant (Abs-81)
01:00 pm - 01:10 pm	Ayan Mahalanobis (Abs-79)	Shiva Hari Subedi (Abs-80)	Resham Prasad Paudel (103)
01:10 pm - 01:20 pm	Manoj Marasini (Abs-107)	Ritu Basnet Thapa (106)	V. Raja Venkat Ram (Abs-95)
01:20 pm - 01:30 pm	Prem Kumari Dhakal (Abs-109)	Anil Chandra Jha (Abs-108)	

01:30 pm - 04:00 pm
Tea Break with Poster Session

1. Thakur Prasad Pokharel (Abs-71)
2. Nikita Shrestha (Abs-82)
3. Sandesh Thakuri (Abs-93)
4. Gaurab Chand (Abs-100)
5. Pramila Kharel (Abs-110)
6. Kedar Nath Chhatkuli (Abs-117)
7. Bikas Tamang (Abs-127)
8. Tuk Rana (Abs-131)
9. Bishnu Prasad Bhandari (Abs-135)
10. Biddha Pokhrel (Abs-144)
11. Prem Prakash Kaphle (Abs-145)
12. Grishma Acharya (Abs-146)
13. Uttam Pokharel (Abs-155)
14. Biseswar Prashad Bhatt (Abs-162)
15. Shanta Gautam (Abs-163)
16. Sujan Pokhrel (Abs-112)
17. Tangwei Liu (Abs-72)
18. Mohammad Azharuddin Sanpui (Abs-112)
19. Sunil Duwadi (Abs-179)

04:00 pm - 5:20 pm	**Session-16 (Annapurna Hall)** **Chair:** Dr. Jhavi Lal Ghimire **Technical Support:** Chudamani Pokharel	**Session-17 (Sagarmatha Hall)** **Chair:** Dr. Pawan Shrestha **Technical Support:** Raghu Bir Bhatta	**Session-18 (Board Room)** **Chair:** Dr. Ramesh Gautam **Technical Support:** Shankar Pariyar
04:00 pm - 04:15 pm	Jhavi Lal Ghimire (Abs-111)	Pawan Shrestha (Abs-98)	Ramesh Gautam (Abs-172)
04:15 pm - 04:30 pm	B. Mallikarjuna (Abs-84)	Neeta Mazumdar (Abs 97)	Sabina Islam (Abs 99)
04:30 pm - 04:45 pm	Sunjay (Abs-17)	Debayan Koley (Abs-18)	Vikas Baranwal (Abs-19)
04:45 pm - 05:00 pm	Aakansha (Abs-45)	Brayan F. Bullang (Abs-30)	Sandeep Singh(Abs-31)
05:00 pm - 05:10 pm	Maddileti Pasupula (Abs-56)	Beyi Boukary(Abs-58)	Shankar Pariyar (Abs-48)
05:10 pm - 05:20 pm	Chudamani Pokharel (Abs-46)	Raghu Bir Bhatta (Abs-74)	M. Ali Akbar (Abs-75)

06:30 pm - 09:00 pm Conference Dinner

Program: Day-3 Sunday, December 15, 2024

07:00 am - 08:30 am ***Breakfast***

08:30 am - 09:00 am **Plenary Talk-4 (Chair: Prof. Dr. Gyan B Thapa) [Annapurna Hall]**
Prof. Dr. Asela K Kulatunga (Abs-5)

09:00 am - 09:30 am **Plenary Talk-5 (Chair: Dr. Russell Alpizar-Jara) [Annapurna Hall]**
Prof. Dr. Dinesh G Sarvate (Abs-3)

09:30 am - 10:00 am **Tea Break**

10:00 am - 12:00 pm	**Session-19 (Annapurna Hall)** **Chair:** Dr. Samir Shrestha **Technical Support:** Chet N. Tiwari	**Session-20 (Sagarmatha Hall)** **Chair:** Dr. Gokul K.C. **Technical Support:** Pushpa Nidhi Gautam
10:00 am - 10:15 am	Samir Shrestha (Abs-140)	Gokul K.C. (Abs-51)
10:15 am - 10:30 am	Upender Reddy Ganga (Abs-105)	Sanjeev Kumar (Abs-114)
10:30 am - 10:45 am	Yajuvindra Kumar(Abs-20)	Abhimanyu Singh Yadav (Abs-21)
10:45 am - 11:00 am	G. Upender Reddy (Abs-49)	Shamsun Naher Begum (Abs-52)
11:00 am - 11:10 am	Chet N. Tiwari (Abs-85)	K. Ramesh Babu (Abs-86)
11:10 am - 11:20 am	Prajwal Bir Singh Kansakar (Abs129)	Pushpa Nidhi Gautam (Abs-164)
11:20 am - 11:30 am	Prakash Joshi (Abs-128)	Laxman Bahadur Kunwar (Abs-87)
11:30 am - 11:40 am	Kumar Subedi (Abs-150)	Tek B. Budhathoki (Abs-165)

11:40 pm – 01:00 pm **Lunch**

01:00 pm – 01:30 pm Closing Session **(Annapurna Hall)**

Chair: Prof. Dr. Chet Raj Bhatta, Head, Central Department of Mathematics, TU

MC: **Dr. Samir Shrestha**, Co-ordinator, Technical Committee ICMA-2024
Remarks by Prof. **Dr. Dil B Gurung**, Convener ICMA-2024 [5 minutes]
Announcement of Best Poster Presentation: **Dr. Hari Nandan Nath** (Member of Steering Committee) [5 minutes]
Remarks by Speakers: 1.
2.
3. [10 minutes]
Announcements: Dr. Parameshwari Kattel (Secretary, Nepal Mathematical Society) [5 minutes]
Remarks by **Prof. Dr. Narayan Prasad Pahari**, President, Nepal Mathematical Society [5 minutes]
Concluding Remark: **Prof. Dr. Chet Raj Bhatta**, Head, Central Department of Mathematics, TU [5 minutes]

Full Papers are requested to submit at the **Journal of Nepal Mathematical Society (JNMS)** (jnms.submission@gmail.com) for the upcoming issues in June and December 2025.

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for the template and other details.

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