SOUVENIR

INTERNATIONAL CONFERENCE

on

"ADVANCES IN MATHEMATICAL SCIENCES, SCIENTIFIC COMPUTING AND ITS APPLICATIONS"

March 22–23, 2024

Organized by

DEPARTMENT OF MATHEMATICS

Centre of Excellence,

Govt. College Sanjauli, Shimla-6

(Funded by DBT-Govt. of India)

सत्यमेव जयते

Shiv Pratap Shukal
Hon'ble Governor, Himachal Pradesh

MESSAGE

It gives me immense pleasure to know that the 'Centre of Exellence-Government College, Sanjauli, Shimla' is organizing International Conference in Mathematics on March 22 & 23, 2024 and a Abstract Book of the conference is also being published to mark this event.

Such Conferences provide a forum to all academicians and mathematicians to share and gain latest trends in cutting edge information, issues and challenges. With the extensive deliberations on different aspects, the participating delegates will be able to upgrade their professional skill besides sharing their professional knowledge with fellow participants.

I extend my good wishes to all the participants and the organizers for the success of the conference.

With warm regards,

(Shiv Pratap Shukal)

Sukhvinder Singh Sukhu
Hon'ble Chief Minister, Himachal Pradesh

MESSAGE

It gives me immense pleasure to extend my warmest greetings to all those gathered for the INTERNATIONAL CONFERENCE on "ADVANCES IN MATHEMATICAL SCIENCES, SCIENTIFIC COMPUTING AND ITS APPLICATIONS." It is indeed an honor to witness the convergence of brilliant minds from across the globe in pursuit of knowledge and innovation.

Mathematics and scientific computing stand as the bedrock of progress in countless fields, driving advancements that shape our world in profound ways. This conference serves as a testament to our collective dedication to pushing the boundaries of human understanding and leveraging cutting-edge technologies for the betterment of society.

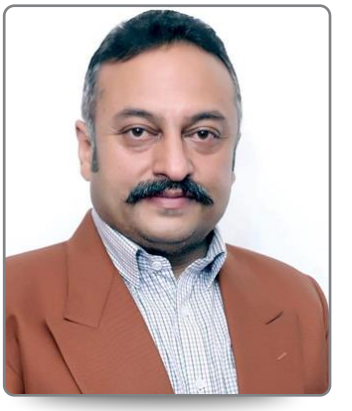
As we navigate through the complexities of the modern age, the role of mathematical sciences and scientific computing in finding solutions to our most pressing challenges cannot be overstated. From unraveling the mysteries of the universe to revolutionizing industries, the impact of your work reverberates far and wide.

I commend the organizers for their tireless efforts in bringing together experts, scholars, and practitioners on this esteemed platform. Your commitment to fostering collaboration and facilitating dialogue paves the way for transformative discoveries and interdisciplinary breakthroughs.

To the participants, I encourage you to seize this opportunity to engage in meaningful exchanges, share your insights, and forge lasting connections. Your contributions not only enrich the discourse within your respective fields but also inspire the next generation of innovators to push the boundaries of what is possible.

As you embark on this intellectual journey, may you find inspiration in the pursuit of knowledge, camaraderie in shared passions, and fulfillment in the impact of your endeavors. I extend my best wishes for a successful and fruitful conference, and I look forward to hearing about the exciting discoveries and developments that emerge from your deliberations.

(Sukhvinder Singh Sukhu)



Rohit Thakur
Hon'ble Education Minister, Himachal Pradesh

MESSAGE

I am delighted to extend my heartfelt congratulations to all those gathered for the **International Conference on "Advances In Mathematical Sciences, Scientific Computing and its Applications."** This conference stands as a beacon of academic excellence, fostering collaboration and innovation in the realms of mathematical sciences and scientific computing.

In an era defined by rapid technological advancement and interdisciplinary collaboration, the significance of conferences like this cannot be overstated. Mathematics and scientific computing serve as the cornerstone of modern education and research, offering invaluable insights and tools to address the complex challenges of our time.

I commend the organizers for their dedication and vision in bringing together a diverse array of experts, scholars, and practitioners from around the world. Your efforts not only facilitate the exchange of knowledge and ideas but also cultivate a vibrant community of learners and innovators committed to pushing the boundaries of human understanding.

To the participants, I encourage you to seize this opportunity to engage in rigorous intellectual discourse, share your research findings, and explore new avenues for collaboration. Your contributions not only advance the frontiers of science and technology but also inspire the next generation of scholars to pursue excellence in their academic pursuits.

As we navigate the ever-evolving landscape of education and research, it is imperative that we continue to invest in the advancement of mathematical sciences and scientific computing. By harnessing the power of innovation and collaboration, we can unlock new possibilities and drive positive change across diverse fields and disciplines.

I extend my sincerest best wishes for a successful and enriching conference. May your deliberations be fruitful, your interactions insightful, and your contributions enduring. Together, let us strive to harness the transformative potential of mathematics and scientific computing for the betterment of society and the advancement of knowledge.

(Rohit Singh Thakur)

Rakesh Kanwar, IAS
Secretary (Education), Himachal Pradesh

MESSAGE

Warm greetings to all participants of the **International Conference on "Advances in Mathematical Sciences, Scientific Computing and Its Applications."** Your dedication to pushing the boundaries of knowledge is commendable. This conference fosters collaboration, innovation, and interdisciplinary dialogue vital for societal progress. Best wishes for fruitful discussions and impactful outcomes.

Together, let's harness the power of education and research to shape a brighter future.

With regards,

(Rakesh Kanwar, IAS)

Prof. Bhart Bhagra
Patron (IC-AMSCA-2024)
Principal, COE, Govt. College Sanjauli, Shimla-6 HP

PATRON'S MESSAGE

I feel extremely happy that the Department of Mathematics of our College, Centre of Excellence, Govt. College Sanjauli, Shimla, Himachal Pradesh is all set to organize the Two day, "**International Conference on Advances in Mathematical Sciences, Scientific Computing and its Applications" (IC-AMSCA-2024)** on March 22-23, 2024. Mathematics is the backbone of reasoning. Since the time human beings started to seek reasons for everything around them. Mathematics has emerged as the language of reason and service. Mathematical acumen is recognized all over the world as a mark of higher order learning. We have been blessed to belong to a nation with distinct contribution to the subject. The world recognizes us as people belonging to the nation of Arya Bhatta, the man who taught the concepts of "zero" and rest is history.

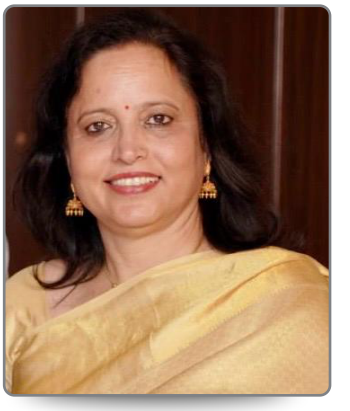
I hope the two-day deliberations will provide a better platform to witness the recent advances in Mathematical Sciences for one and all in this conference. I heartily appreciate the efforts of department of Mathematics of this college for coining the idea of organizing the conference and their dedicated team deserve my gratitude for untiring zeal they have shown throughout the preparatory period of the conference.

I extend a very warm welcome to the chief guests, the keynote speaker, our resource person and invited speakers, paper presenters and the participants of this conference.

Last but not the least I thank funding agency DBT, Star College Scheme, Department of Biotechnology, Ministry of Science and Technology, Government of India, New Delhi-110003.

Principal

Prof. Bhart Sharma
Chairperson (IC-AMSCA-2024)
Dean of Sciences, COE, Govt. College Sanjauli, Shimla-6 HP



CHAIRPERSON'S MESSAGE

Dear friends

It gives me immense pleasure to invite you to two days, "International Conference on Advances in Mathematical Sciences, Scientific Computing and its applications "(ICAMSCA-2024) being organised by Department of mathematics C.O.E, G.C. Sanjauli Shimla-6.

The main aim of this conference is to promote mathematical research and provide a common platform for academicians, scientists, engineers and young researchers to discuss the new methods and area of research in the field of Mathematical Sciences.

Being the chairman of this conference, I extend a warm welcome to all guests, participants, researchers and other dignitaries. The conference will not only provide a platform to share their achievements and experience but also give an opportunity for meeting old friends and making new ones.

I take this opportunity to express my gratitude to authors who have submitted well written papers. I also express my gratitude to sponsoring agency Department of the Biotechnology, Government of India. I am indebted to Principal Professor Bharti Bhagra for taking keen interest for organising this conference.

Lastly, I express my deep appreciation and gratitude to the effort put by Department of Mathematics for making this event a reality.

I congratulate all the concerned with gratitude and wish the conference a great success.

Bharti Sharma

Dr. Girish Kapoor
Convener (IC-AMSCA-2024)
HOD Mathematics, COE, Govt. College Sanjauli, Shimla-6 HP

CONVENER'S MESSAGE

It is my proud privilege to welcome all the delegates from different states of the country participating in the Two day "International Conference on Advances in Mathematical Sciences, Scientific Computing and its applications" (ICAMSCA-2024) on 22nd & 23rd March, 2024 being organised by Department of Mathematics, Centre of Excellence, Government College Sanjauli, Shimla-6, Himachal Pradesh.

The primal aim of this conference is to bring the researchers working in the different fields of Mathematical Sciences from all over the world so that they can interact and exchange the new trends and advances in recent researches in different fields of Mathematics. Almost all the scientific and technological fields are somehow connected. This conference will provide an essential environment of future collaborative works between different scientific and technological fields. Efforts have been made to invite leading mathematicians to deliver key note address and invited lectures.

Prof. (Dr.) Riddhi Shah, recipient of the Young Scientist award of INSA (1995), Co-Chair National Board of Higher Mathematics (NBHM), is the key note speaker of the conference. There are 08 Invited Talks by eminent Mathematicians and more than 150 delegates from different parts of the country are expected to participate in this conference. There are more than 140 research paper presentations by researchers from all over the country.

I put on records my profound gratitude to DBT, Star College Scheme, Department of Biotechnology Government of India.

I am highly grateful to Principal Prof. Bharti Bhagra for her motivation, invaluable guidance and encouragement. Without her unconditional support this conference would not have been the light of the day. I am also thankful to Dr Naresh Verma, Vice – Principal and all staff members of the college for their continuous support.

Dr Girish Kapoor

Editor – in – Chief

Dr Girish Kapoor

Associate Editor

Dr Anjana Sharma

Editorial Advisory Board

Dr Rakesh Kumar

Dr Tilek Raj Sharma

Dr Pushap Lata Sharma

Dr Satish Thakur

Dr Sumit Gupta

Dr Poonam Sharma

Disclaimer: *The Editors of the Souvenir IC-AMSCA-2024 do not necessarily agree with the views expressed and reported in the abstracts published herein. The Editors do not claim any responsibility any liability for statement made and opinion expressed by authors. The formations and opinions presented in the Souvenir IC-AMSCA-2024 reflect the views of the authors and not of its editorial board*

IC-AMSCA-INVITED TALKS

Key Note Address

Some Aspects of Dynamics

Prof. (Dr.) Riddhi Shah
Professor of Mathematics, Jawaharlal Nehru University, Delhi, India
Email: riddhi.kausti@gmail.com

Abstract:
We will introduce dynamical systems with a few examples and provide an overview of distal maps, which were introduced by David Hilbert. We will mention a couple of our results on the behaviour of orbits of distal automorphisms on locally compact groups. Then we will briefly discuss the dynamics of billiards, a related illumination problem and the contribution of an inspiring woman mathematician. We will end the talk with a brief discussion on the Indian Women and Mathematics (IWM) initiatives in India to promote mathematics research and teaching among women.

IT-01

Prof. (Dr.) Surjeet Singh
Former Professor of Mathematics, King Saud University, Saudi Arabia

IT-02

Exploring the Historical Legacy of Ancient Bharat's Mathematical Innovations

Prof. (Dr.) R. P. Sharma
Former Professor of Mathematics, H.P. University, Shimla-5, India
Email: rp.math.hpu@gmail.com ; rp_math_hpu@yahoo.com

Abstract
The ancient tradition of mathematics in Bharat is long and magnificent. It dates to the earliest times, and certainly many of the Indian innovations from a period starting 5000 years ago are rather parallel to contemporary mathematics. Mathematics and Indians go hand-in-hand, and there are innumerable instances to elaborate this fact. *We will discuss some results related to Mathematical innovations in ancient Bharat.*

IT-03

Rings which are Matrix Rings

Prof. (Dr.) Dinesh Khurana
Professor of Mathematics, Panjab University Chandigarh
Email: dkhurana@pu.ac.in

Abstract

It is useful to know when a ring is isomorphic to a matrix ring over some ring. This fundamental problem has been studied extensively. We will discuss some results related to this problem.

IT-04

Quadratic forms and a new invariant of a field

Dr. Anjana Khurana
Associate Professor of Mathematics, Panjab University Chandigarh
Email: anjana@pu.ac.in

Abstract:

Let F be a field of characteristic not 2 with finitely many square classes. We define a new rational valued invariant of F and call it the division probability of F. We show that if two fields have isomorphic Witt rings, then their division probabilities are equal. We also show that rational numbers of type (2^r-1)/2^{r+1} always occur as division probability for a suitable field.

IT-05

Study of eigenvalues of some matrices via dilations

Prof. (Dr.) Mandeep Singh
Professor of Mathematics, Sant Longowal Institute of Engineering & Technology, Lonowal
Email: msrawla@yahoo.com

IT-06

On Some Non-commutative Versions Of Cauchy-schwarz Inequalities In Matrix Algebra

Prof. (Dr.) Rajesh Kumar Sharma
Professor of Mathematics, H.P. University, Shimla-5, India
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Abstract

We discuss non-commutative versions of some inequalities related to the Cauchy-Schwarz inequality in matrix algebra. We consider inequalities involving positive unital linear maps and demonstrate how positive unital linear maps can be used to obtain bounds for the eigenvalues and spreads of Hermitian matrices. Some complementary inequalities and Jensen's inequalities in matrix algebra are also discussed here.

IT-07

Data Generation using Modeling & Simulation for Machine Learning: Revolutionizing Training Datasets

Dr. Harpreet Singh
Faculty of Engineering, Tel-Aviv University, Israel
Email: akalharpreet@gmail.com

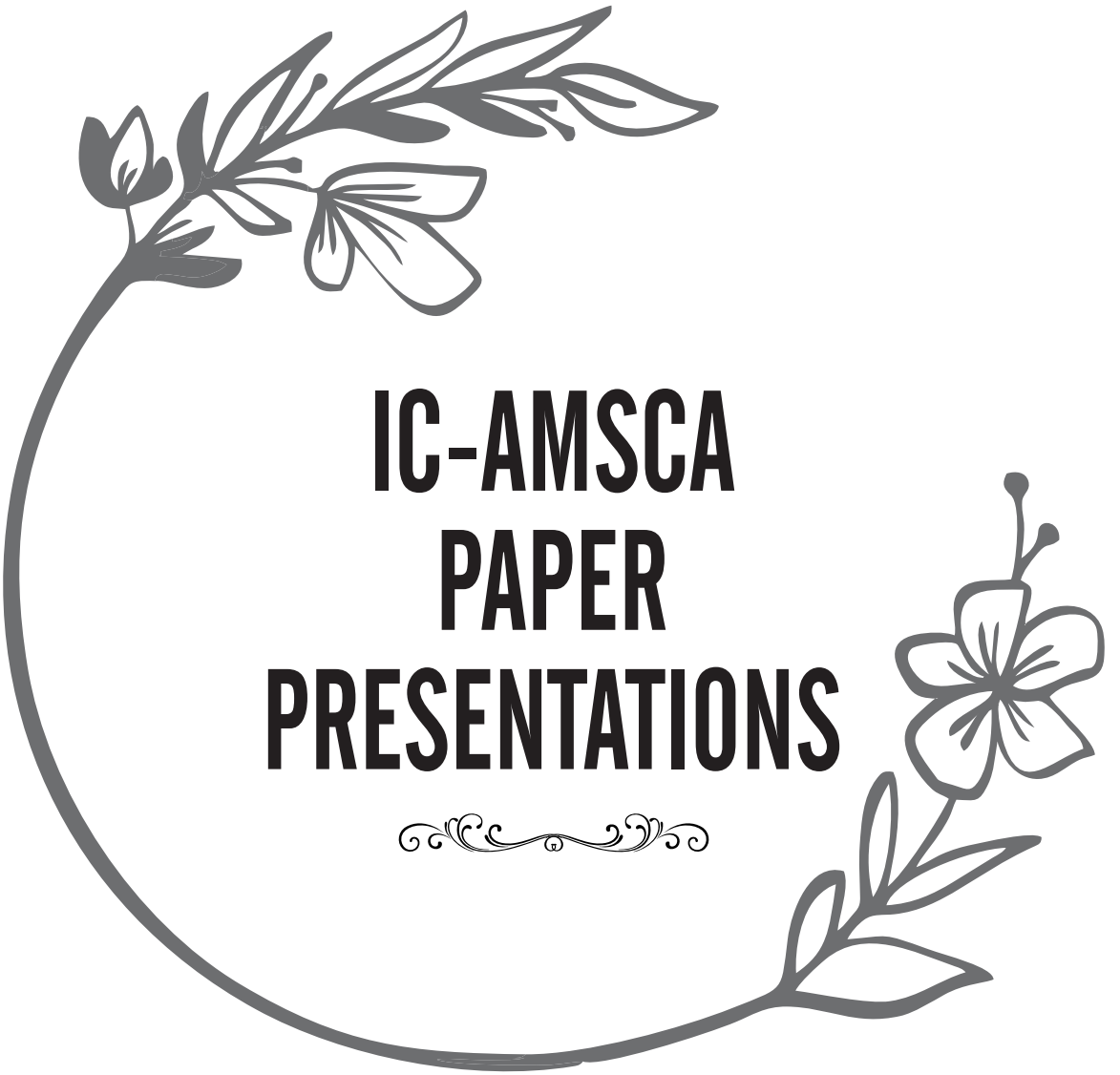
Abstract

In the rapidly advancing field of machine learning, the availability of high-quality training datasets is crucial for the success of models. The talk explores the paradigm shift in data generation through the innovative integration of modelling and simulation techniques. By harnessing the power of virtual environments, this approach not only addresses data scarcity challenges but also empowers machine learning algorithms with diverse and complex scenarios. The keynote will delve into the transformative impact of utilizing simulated data on model robustness, generalization, and real-world applicability. Join us to discover the cutting-edge strategies that promise to reshape the landscape of machine learning by redefining how we generate and leverage training datasets.

IT-08

The Role of Mathematics in Economic Growth

Dr. Aradhya Sood
Assistant Professor, University of Toronto
Email: aradhya.sood@rotman.utoronto.ca



IC-AMSCA PAPER PRESENTATIONS

Paper-01

STUDY OF THE NONLINEAR EVOLUTION EQUATIONS AND THEIR APPLICATIONS USING LIE SYMMETRY ANALYSIS

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ABSTRACT

By using the Lie symmetry analysis, we obtain the infinitesimals for the (2 + 1)-dimensional asymmetric Nizhnik-Novikov-Veselov equation that admits an infinite number of possibilities for its Lie vector fields. Through two stages of Lie symmetry reductions, we derive several nonlinear ordinary differential equations (ODEs). By solving these nonlinear ODEs with the help of symbolic computation, we obtain some group- invariant solutions in the forms of dynamics of solitons like multi-solitons, elastic behaviour multi-solitons, single soliton, doubly soliton, parabolic wave solitons, nonlinear behaviour of wave profile and elastic interaction soliton solutions of the equation. These results are simulated through 3D- and 2D-plots that exhibit the different dynamical structures of these solutions that are presented for different values of the free valued function at different values of the time.

Keywords – Invariant soliton solution, Lie symmetry method, Commutator table, Infinitesimal generator.

Paper-02

MATHEMATICAL STUDY OF RHEOLOGY OF RASPBERRY PUREE THROUGH A CIRCULAR TUBE BY HERSCHEL-BULKLEY FLUID MODEL

Kamal Debnath
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ABSTRACT

Raspberry puree exhibiting pseudoplastic nature of flow through a circular tube due to pressure difference is examined in this study. The experimentally obtained rheological flow parameters for raspberry puree are taken into consideration under certain prescribed conditions. As the puree contains yield stress, so Herschel-Bulkley fluid model is employed to study the flow behaviour. The appropriate flow assumptions are considered to obtain the governing equations in cylindrical coordinate system. The governing equations are solved analytically to find the velocity and other related expressions. The impact of rheological parameters of raspberry puree on the plug velocity, velocity in the deformed region, volumetric rate of flow, average velocity and skin friction are illustrated from graphs and tables and conclusions are drawn from physical point of view.

Key words: Raspberry puree, Herschel-Bulkley fluid, Yield stress, Plug velocity, Skin friction.

Paper-03

MHD CASSON FLUID FLOW PAST VERTICAL PLATE WITH RAMPED SURFACE CONCENTRATION AND PARABOLIC MOTION

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ABSTRACT

This article examines the impact of thermo-diffusion and parabolic motion on the unsteady free convective MHD. Casson model is used for studying fluid around a vertical plate in a porous medium, accounting for heat generation, thermal radiation, and chemical reaction with a surface concentration that increases gradually. The fluid is conductive to electricity. The dimensionless equations are solved using the Laplace transform method to derive analytical formulas for velocity, temperature, and concentration. The text also covers precise answers for skin friction, Nusselt Number, and Sherwood Number. Numerical results are acquired using Matlab software (finite difference approach) to gain a comprehensive understanding of the physics of the problem. The results are then presented in graphical and tabular form.

Paper-04

On the geometry of screen generic lightlike submanifolds in an indefinite Kaehler statistical manifold

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ABSTRACT

This paper introduces the notion of screen generic lightlike submanifolds of an indefinite Kaehler statistical manifold equipped with a quarter symmetric non-metric connection. It delves into characterizing the parallelism and integrability of distributions alongwith developing findings concerning mixed geodesic screen generic lightlike submanifolds. Additionally, the research work explores the structure of totally umbilical screen generic lightlike submanifolds within the context of an indefinite Kaehler statistical manifold.

Paper-05

SOME CONTRIBUTION TO VEDIC MATHEMATICS

Hitendra Kumar, P. Dave
Associate Professor Of Statistics & Convenor of Certificate Course in Vedic Mathematics,
B. J. Vanijya Mahavidyalaya, Vallabh Vidyanaga, Gujarat, India
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ABSTRACT

Vedic Mathematics is an Indian ancient system of mathematical calculations or operations techniques developed in the year of 1957 with 16 Sutra's (formulae) and 13 sub-Sutra's (sub- formulae. Vedic maths is a system of mathematics that was discovered by an Indian mathematician, **Jagadguru Shri Bharathi Krishna Tirthaji** during A.D. 1911 and 1918. He printed his findings in a Vedic Mathematics book – Tirthaji Maharaj. Vedic mathematics is also called mental mathematics in the mathematical world. We can say that the brain's capacity and its speed of calculations increases fivefold with the practice of Vedic maths. In competitive examinations, students find difficult to solve the aptitude questions effectively with very less or small time durations. Even though students are able to understand the problem, they are not able to speedup calculation process. In this research article, I have discussed some basic Vedic mathematical calculations techniques to find square value, multiplication, and subtraction of fractional decimal numbers, which are based on " Sutras" of Vedic Mathematics. This paper will definitely able to find that the techniques of Vedic Mathematics significantly improves the speed of calculations while performing some basic mathematical operations. I humbly wish that this paper will be useful to play an active and supportive role in actual research of Vedic mathematics and techniques to improve the speed of calculations especially while writing any competitive examinations.

Paper-06

MATHEMATICAL MODELLING OF IMPACT OF ALCOHOL AND SMOKING ON CARDIOVASCULAR DISEASES

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ABSTRACT

This paper focuses on mathematical modelling to understand the behaviour of cardiovascular diseases. Utilizing advanced mathematical techniques, we aim to simulate the complex interactions within the cardiovascular system, considering factors such as alcohol and smoking information. By integrating alcohol metabolism and smoking toxin accumulation with cardiovascular disease risk, we propose a system of ordinary differential equations to provide valuable insights into disease progression, risk

factors, and potential interventions. The goal is to enhance our understanding of cardiovascular diseases, enabling more accurate predictions and informed decision-making for healthcare professionals. The equilibrium point has been found to be locally stable. This interdisciplinary approach bridges mathematics and medicine to contribute to improved cardiovascular health outcomes.

Key words: mathematical modelling; cardiovascular disease; disease model; equilibrium point; stability.
MSC 2020: 92-10; 37D35;34D20.

Paper-07

RELATION BETWEEN OPERATOR MONOTONE FUNCTIONS AND CND FUNCTIONS AND THEIR APPLICATIONS

Dr. Rajinder Pal
Assistant Professor**,** Mata Gujri College, Fatehgarh Sahib. Punjab

ABSTRACT

In this paper we establish various results about CND functions; for instance, f ◦ g is CND for an operator monotone function f: $[0,\infty) \rightarrow [0,\infty)$ and a CND function g: $R \rightarrow [0,\infty)$. Some non-trivial functions including $|sin\ x|^{r}$, $log(cosh\ x)$ and $|tanh\ x|^{r}$ for $r \in [0,2]$ are proven to be CND.

Paper-08

COMPACT ASTROPHYSICAL OBJECTS WITH A GENERALISED CHAPLYGIN EQUATION OF STATE

Bhavesh Suthar, B. S. Ratanpal
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ABSTRACT

An exact solution of Einstein's field equations in isotropic coordinates for an anisotropic distribution of matter is derived in this work by taking into consideration a generalised Chaplygin equation of state and a particular form for one of the metric potentials. To validate the model's viability, we analysed all of the physical characteristics of a realistic star. The model has been analysed for compact star candidate 4U 1538-52, and its results have been analysed.

Keywords: General relativity, Isotropic coordinates, Relativistic stars, Compact stars, Equation of State

Paper-09

EFFECT OF ROTATION AND MAGNETIC FIELD ON MICROPOLAR FLUID HEATED AND SOLUTED, PERMEATED WITH SUSPENDED PARTICLES SATURATING POROUS MEDIUM

Sumit Gupta
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ABSTRACT

This paper deals with the convection of micropolar fluids heated and soluted from below in the presence of suspended particles (fine dust) and uniform vertical rotation $\Omega(0,0,\Omega)$ and uniform vertical magnetic field $H(0,0,H)$ in a porous medium. Using the Boussinesq approximation, the linearized stability theory and normal mode analysis, the exact solutions are obtained for the case of two free boundaries. It is found that the presence of the suspended particles number density, the rotation parameter, stable solute, magnetic field intensity and medium permeability bring oscillatory modes which were non–existent in their absence. It is found that the presence of coupling between thermal and micropolar effects, rotation parameter, solute parameter and suspended particles may introduce overstability in the system. Graphs have been plotted by giving numerical values to the parameters accounting for rotation parameter $\Omega(0,0,\Omega)$, magnetic field $H(0,0,H)$ solute parameter, the dynamic microrotation viscosity κ and coefficient of angular viscosity γ' to depict the stability characteristics, for both the cases of stationary convection and overstability. It is found that Rayleigh number for the case of overstability and stationary convection increases with increase in rotation parameter, as well as with magnetic field intensity, solute parameter and decreases with increase in micropolar coefficients and medium permeability, for a fixed wave number, implying thereby the stabilizing effect of rotation parameter, magnetic field intensity ,solute parameter and destabilizing effect of micropolar coefficients and medium permeability on the thermosolutal convection of micropolar fluids.

Keywords: Micropolar fluid; rotation parameter; suspended particles (fine dust); microrotation; magnetic field intensity ;solute parameter; medium permeability; coefficient of angular viscosity.

Paper-10

STATIONARY CONVECTION IN THE THERMAL INSTABILITY OF NON-NEWTONIAN FLUID: FREE-FREE, RIGID-RIGID AND RIGID-FREE BOUNDARY CONDITIONS

Pushap Lata Sharma and Ajit Kumar
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Assistant Professor, Department of Evening Studies, Himachal Pradesh University, Shimla, India
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ABSTRACT
Thermal instability phenomena in non-Newtonian fluids have garnered significant attention due to their relevance in various industrial and geophysical processes. This study investigates the stationary convection behaviour arising from thermal instability in non-Newtonian fluids under different boundary conditions: free-free, rigid-rigid, and rigid-free. The governing equations incorporating the non-Newtonian nature of the fluid are solved numerically using normal mode analysis and Galerkin type weighted residual method. The analysis focuses on understanding the influence of boundary conditions on the onset and characteristics of convection patterns, including temperature distributions, flow velocities and convective heat transfer rates. The effects of the Rayleigh number of nanoparticles, Lewis number, modified diffusivity ratio and Jeffrey parameter are investigated analytically and graphically.
Keywords: Non-Newtonian fluid, Rayleigh number, Galerkin type weighted residual method

Paper-11

AN OVERVIEW OF BINARY LINEAR CODES IN INFORMATION THEORY

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ABSTRACT
Binary linear codes are an essential concept in information theory and coding theory, playing a crucial role in error detection and correction in various communication systems. These codes are widely used for transmitting data over communication channels, including the internet, wired and wireless networks and telecommunications systems. Binary encoding ensures reliable and efficient data transmission, even across long distances. In fields like telecommunications and audio processing, binary code is essential for representing and processing digital signals. Digital signal processing techniques rely on binary representation for efficient manipulation of signals. This research paper provides an overview of binary linear codes, discussing their fundamental properties, encoding and decoding techniques, as well as their applications in modern communication systems.

Paper-12

EXPLORING SERRE'S CONJECTURE: RECENT ADVANCES AND NEW PERSPECTIVES

Gopal Sharma
Research Scholar
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Email:gopalsharmasml@gmail.com
Under the guidance of, Dr. Sampat Kumar Sharma, March 2024

ABSTRACT

Serre's Conjecture stands as a central challenge in algebraic geometry and commutative algebra, posing questions about the behavior of modules over polynomial rings. This conjecture, formulated by Jean-Pierre Serre in the 1950s, has sparked decades of research, with mathematicians striving to understand its implications and uncover potential solutions.

In this talk, we delve into the rich tapestry of Serre's Conjecture, surveying its historical significance and outlining recent advances in the field. We explore the conjecture's fundamental principles, including its formulation for projective modules. Drawing upon techniques from algebraic geometry, commutative algebra, and homological algebra, we highlight key developments that have propelled our understanding forward.

Serre's conjecture has been proved in certain special cases and in some generality, but as of my last update in March 2024, it remained open in its full generality. Progress has been made using techniques from algebraic geometry, commutative algebra, and homological algebra. Many mathematicians have contributed to understanding various aspects of the conjecture. However, a complete resolution of Serre's conjecture for projective modules remains an active area of research in algebraic geometry and commutative algebra.

Paper-13

MATHEMATICAL MODEL FOR NANOFLUID FLOW PAST AN OSCILLATING VERTICAL PLATE CONSIDERING MAGNETIC FIELD AND RADIATION

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ABSTRACT

An analytical expression for unsteady hydromagnetic boundary layer flow passing an oscillating vertical plate radiation and uniform transverse magnetic field is found. Rosseland diffusion flux model is employed to simulate thermal radiation effects. For dimensionless momentum and energy conservation problems, the Laplace transform provides an analytical solution. Results for velocity and temperature are analyzed and visualized. The velocity of nanofluid increases with radiation parameter Nr, Grashof number Gr, and time, but decreases with magnetic field and Prandtl number Pr. Nanofluid temperature rises with time and decreases with the growth in Nr and Pr.

Paper-14

ON SOME BOUNDS FOR CEBYSEV FUNCTIONAL IN TERMS OF MEAN AND EXTREME VALUES

Girish Kapoor

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ABSTRACT

In this paper some bounds for the unweighted Cebysev functional involving two n-tuples of real numbers is established in terms of their means and extreme values. Some related bounds for span of the roots of polynomial equation and bounds for spread of eigen values of a square matrix with real spectrum is obtained.

Keywords: Cebysev's functional, Discrete Korkine type Identity, Eigenvalues of matrix, roots of polynomial equation.

Paper-15

ADVANCED TEXT ENCRYPTION SCHEME USING ELLIPTIC CURVE CRYPTOGRAPHY

Shalini Gupta

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ABSTRACT

Elliptic curve cryptography is a powerful tool for securing data communications. This study addresses the drawbacks of traditional text encryption methods, such as complexity and increased security risks due to shared code tables. In the present paper, we propose an efficient and authenticated text encryption scheme that eliminates the need for shared code tables, reducing communication overhead. Our method utilizes elliptic curve coordinates as keys and undergoes rigorous security analysis, demonstrating high plaintext sensitivity and efficiency in encryption and decryption. Compared to existing schemes, our approach shows enhanced resilience against modern cryptanalysis and is suitable for secure text communication in real-time applications.

Keywords: Elliptic Curve Cryptography; Encryption

Paper-16

THERMOELASTICITY AND MASS DIFFUSION INTERACTION IN HALF-SPACE BASED ON MOORE GIBSON THOMPSON THEORY

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ABSTRACT

Elasticity is the property of a material body by virtue of which it regains its original configuration on the removal of the deforming force. The theory of elasticity is concerned with the study of the mechanical behaviour of deformable materials under the application of external forces. Classical elasticity theory neglects temperature changes due to deformation, assuming them to be negligible. However, real-world observations often contradict this assumption, especially during sudden and significant temperature changes. When elastic materials are subjected to heat, they undergo deformation, and this heating can induce thermal stresses within the material. The theory which considers the impact of temperature on the mechanical field but not otherwise is known as the uncoupled theory of thermoelasticity. This theory presents two predictions that are inconsistent with physical observations. Firstly, its heat conduction equation lacks elastic terms. Secondly, the heat equation it provides is parabolic, implying infinite speeds of propagation for heat waves. Later on, coupled thermoelasticity emerged to address the first limitation, integrating mechanical and thermal fields, but both theories still share the second shortcoming. To eliminate this paradox, generalized theories of thermoelasticity have evolved, according to which, thermoelastic signals propagate with finite speed in the medium. In solid materials, the diffusion process depends on temperature within a certain range. The phenomenon of thermoelastic diffusion in solids is important due to its wide implementation such as satellite and spacecraft problems, fabrication of semiconductor devices, formulation of base and emitter in different types of transistors, optimal oil extraction from hydrocarbon reservoirs, separation of polymers, etc.

The process of diffusion is governed by Fick's law, which states that mass flux is proportional to the concentration gradient. To investigate the relationship between strain, temperature, and diffusion a new model of thermoelastic diffusion interaction has been derived which allows the thermo-diffusive waves to propagate at finite speeds. This model is based on the MGT equation incorporated into the mass diffusion and heat conduction equation augmented with two relaxation times. In this paper, the introduced model is used to investigate a two-dimensional thermoelastic diffusion problem for a homogeneous isotropic half-space. Initially, the medium is kept quiescent and the bounding surface of half space is subjected to thermal and concentration loading. Laplace-Fourier transformed domain with initial and bounding constraints are used to solve the problem analytically. To obtain the results in the space-time domain, the numerical inversion technique is applied. The differences between the presented model and previous theories are graphically presented and discussed in detail.

Paper-17

ON COMMUTING GRAPH OF AFFINE GROUP AFF(1, Z_P)

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ABSTRACT
The commuting graph $\Gamma = C(G, \Omega)$ on a non-abelian group G consist of a vertex set $\Omega \subseteq G$ and any two vertices f and g in Ω are adjacent if and only if $fg = gf$ in G. In this article, we have studied certain distant and detour distant properties of commuting graph Γ on one dimensional affine group Aff(1, Z_p), p an odd prime. We have also investigated the clique number, chromatic number and independence number of Γ. Further, we determine the metric dimension, resolving

Paper-18

ORBIT PROBLEM IN SMASH PRODUCTS

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ABSTRACT
In this paper we will prove the fuzzy analogous of Orbit Problem. Let R be a K-algebra with 1,over a commutative ring with 1 and G be a finite group whose identity is also denoted by 1,then R is a K[G]* module algebra. Conversely, if R is a K[G]* module algebra, then R is graded by G. We may thus construct the smash product R# K[G]*.For our convenience, here we write S=R# K[G]*.Thus the orbit problem is "if λ is a prime fuzzy ideal of R,then there exists a prime fuzzy ideal μ of S such that $(\mu)^* = \lambda_G$. Further; μ is unique upto its G-orbit."
Key Words: K-algebra, Module Algebra, Smash Product, G-orbit.

Paper-19

OSCILLATORY CONVECTION IN ROTATING JEFFREY NANOFLUID : DARCY-BRINKMAN MODEL

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ABSTRACT

This study investigates the impact of variable gravity on both stationary and oscillatory convection within a rotating layer of Jeffrey nanofluid within a Darcy-Brinkman porous medium. Utilizing the normal mode technique, the research assesses the effects of exponential and cubic variable gravity on the onset of stationary and oscillatory convection, both analytically and graphically. The investigation explores how variable gravity influence various factors including the Jeffrey parameter, rotation rate, Darcy-Brinkman number, Lewis number, diffusivity ratio, porosity of the porous media and nanoparticle Rayleigh number for both stationary and oscillatory convection. Results reveal that negative exponential variable gravity exerts a stabilizing effect on both types of convection.

Keywords: Jeffrey nanofluid, variable gravity, oscillatory convection, Darcy-Brinkman model, normal mode technique, rotation

Paper-20

STUDY OF NON-LINEAR STABILITY IN THE RESTRICTED THREE-BODY CONFIGURATION WITH HETEROGENEOUS BODY AND FINITE-STRAIGHT SEGMENT

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ABSTRACT

The main focus of our work is to analyze the non-linear stability of the triangular equilibrium points L_4 & L_5 in the restricted three-body problem (R3BP). The condition of stability has been found under the influence of the heterogeneous primary and a radiating finite-straight segment secondary and also under the effect of Coriolis as well as Centrifugal forces The conditions of KAM Theorem have been examined in the presence of resonance cases and found that these conditions have been failed for three values of mass ratios μ_1, μ_2 & μ_3. Except for these three values, L_4 & L_5 are stable in the non-linear sense within the range of linear stability $0 < \mu < \mu_c$ where μ_c is the critical value of mass parameter μ. Consequently, in the above-mentioned mentioned perturbations the triangular equilibrium points are unstable for these three values of mass ratios.

Paper-21

MATHEMATICS IN THE CONTEXT OF THE FUZZY SETS : IDEAS CONCEPTS AND SOME REMARKS ON THE HISTORY AND TRENDS OF DEVELOPMENT

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ABSTRACT

The main aim of this paper is to discuss the basic ideas and concepts of so-called "Fuzzy Mathematics" and to give a brief survey of history and of some trends in recent development of mathematics and its applications in the context of fuzzy sets.As a potential reader we imagine a mathematician,who is not working in the field of "Fuzzy Mathematics", but wishes to have some idea about this vast field in modern science.

Keywords: fuzzy set,fuzzy logic,fuzzy real number

Paper-22

DISTINGUISHING LABELLING OF SETS UNDER GROUP ACTION

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ABSTRACT

The concept of distinguishing number is originated from an elementary problem known as the Frank Rubin's Key problem, which states that: "*Professor X (who is blind) has n keys on a circular key ring, but he cannot see them, therefore the question is: How many shapes does Professor X need to use in order to keep n keys on the ring and still be able to select the proper key by feel?"*

In this paper, we proved that the distinguishing number for the action of $\underset{A_n}{\rightarrow}$ (demi octahedral group) on the set [2n] = {1, 2, ..., 2n} is the nth term of the sequence "1, 2, 3, 3, 4, 4, 4, 5, ... (n appears n − 1 times prepended with 1)". An optimal iterative algorithm to establish a closed formula to compute a distinguishing labelling of [2n] under the natural action of $\underset{A_n}{\rightarrow}$is provided. Also, a closed formula to compute the distinguishing number for the above said action is established, in the sequel, it is observed that finding the distinguishing number for the action of $\underset{A_n}{\rightarrow}$on the set [2n] is equivalent to answering a combinatorial problem which states that "*what is the minimum number of boxes required to arrange n distinct pair of identical balls in such a way that exactly one box can contain only one pair of identical balls, but two pairs of identical balls cannot be completely contained in two boxes with one pair in each box".*

Paper-23

A COMPARATIVE STUDY OF MHD AND WITHOUT MHD ON UNSTEADY FLOW WITH SLIP CONDITION AND MASS TRANSFER EFFECT

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ABSTRACT

An attempt has been made for a comparative study of an oscillatory mass transfer flow through a channel in presence of MHD and without MHD. A uniform magnetic field is assumed to be applied normal to the walls of the channel when MHD is considered. The governing equations are solved in the closed form. The effect of velocity slip (h), solutal Grashof number (Gm), Schimdt number (Sc), chemical reaction parameter (Cr) and radiation parameter (Ra) on the flow and transports characteristics are studied graphically and the result is physically interpreted.

Keywords: MHD, slip flow regime, porosity.

Paper-24

ANALYSIS OF FREE VIBRATIONS IN AN ISOTROPIC NONLOCAL ELASTIC HOLLOW CYLINDER WITH DOUBLE POROSITY

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ABSTRACT

This article explores the behaviour of free vibrations in an isotropic nonlocal elastic hollow cylinder with double porosity. The study employs Iesan's model to establish constitutive relations and governing equations. Through the time harmonic variation technique, the governing partial differential equations are transformed into a set of ordinary differential equations. The frequency equation for vibration continuation is derived under traction-free boundary conditions. To analyze free vibrations, the frequency equation undergoes further examination using a numerical iteration method facilitated by MATLAB software. Graphical representations illustrating the frequency shift against the mode number are presented for both nonlocal and local elastic hollow cylinders with double porosity, utilizing computer-simulated numerical results from analytical solutions. Additionally, tables are included to display natural frequencies as a function of mode number. This research has diverse applications, contributing to the development of materials with double porosity in engineering and manufacturing processes.

Paper-25

ROLE OF MATRICES IN DYNAMICAL SYSTEM

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ABSTRACT
Mathematics is known as “soul" of science. This is a language of universe, no natural phenomenon is untouched from mathematics. This is also a science of precision and accuracy and matrix is considered as one of its important tool. In this paper we have discussed how matrices play an important role to study the behaviour of dynamical system. The formulation of matrices in dynamical system, their determinant and eigenvalues are also discussed. The matrices having complex eigenvalues with their geometrical significance are also discussed as a special case of dynamical system.
Keywords: Matrix, Eigenvalue, Eigenvector, Determinant.

Paper-26

ON THE PRINCIPLE OF THE EXCHANGE OF STABILITIES IN MULTICOMPONENT CONVECTION IN POROUS MEDIUM USING DARCY-BRINKMAN MODEL

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ABSTRACT
In the present communication, a sufficient condition for characterizing nonoscillatory motions, which may be neutral or unstable, for Multicomponent convection in a porous medium has been derived. It is analytically proved that the principle of the exchange of stabilities, in Multicomponent convection configuration in a porous medium, is valid in the regime $\frac{R_1 E_1 \sigma}{2\pi^4 \tau_1^2} + \frac{R_2 E_2 \sigma}{2\pi^4 \tau_2^2} + ... + \frac{R_{n-1} E_{n-1} \sigma}{2\pi^4 \tau_{n-1}^2} \le 1,$, where $R_1 > 0, R_2 > 0, ..., R_{n-2} > 0$ and $R_{n-1} > 0$ are the $n-1$concentration Rayleigh numbers, and $\tau_1 > 0, \tau_2 > 0, ..., \tau_{n-2} > 0$ and $\tau_{n-1} > 0$ are the Lewis numbers for $n-1$ concentration components respectively, σ is the Prandtl number, $E_1, E_2, ..., E_{n-2}$ and E_{n-1} are positive constants. It is further proved that this result is uniformly valid for any combination of rigid and free boundaries.

Keywords: Multicomponent convection, Porous medium, Darcy-Brinkman model, The principle of the exchange of stabilities, Concentration Rayleigh number.

Paper-27

LIMITS ON THE RATE OF COMPLEX GROWTH FOR DISTURBANCES IN A COUPLE-STRESS FLUID WITH A UNIFORM MAGNETIC FIELD

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ABSTRACT

The thermal instability of a couple-stress fluid acted upon by uniform vertical magnetic field and heated from below is investigated. Following the linearized stability theory and normal mode analysis, the paper through mathematical analysis of the governing equations of couple-stress fluid convection with a uniform vertical magnetic field, for the case of free and perfectly conducting boundaries shows that the complex growth rate σ of oscillatory perturbations, neutral or unstable for all wave numbers, must lie inside a semi-circle

$$|\sigma|^2 < \left[\frac{R}{p_1 \pi^2 \left(3\pi^2 F + \frac{1}{p_2} \right)} \right]^2 ,$$

in the right half of a complex σ-plane, where R is the Rayleigh number, p_1 is the thermal Prandtl number, p_2 is the magnetic Prandtl number and F is the couple-stress parameter, which prescribes the upper limits to the complex growth rate of arbitrary oscillatory motions of growing amplitude in the couple-stress fluid heated from below in the presence of uniform vertical magnetic field. The result is important since the exact solutions of the problem investigated in closed form, are not obtainable.

Paper-28

EXPLORING VARIABLE DENSITY EFFECT ON THE STRESSES OF ISOTROPIC ROTATING DISK BY USING TRANSITION THEORY AND GENERALIZED STRAIN MEASURES

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ABSTRACT

This research manuscript undertakes a comprehensive exploration of variable density on the stresses of isotropic rotating disk at initial and fully plastic stages by using Seth's transition theory and generalized strain measures. This model includes the stress– strain relation and equilibrium equations. The effectiveness and reliability of this parameter i.e. variable density on angular speed and stresses are demonstrated and considered. From the obtained results, it has been observed that rubber material disk requires higher angular speed to yield at the inner surface as compared to polypropylene material disk. The rubber disk is more comfortable than polypropylene disk. With the addition of variable density parameter at the inner surface of a disk made of natural rubber/polypropylene for initial yielding the value of angular speed decreases, but reverse results are obtained for subsequent yielding surface. The circumferential stress is maximum at the inner surface of the natural rubber material disk in comparison to polypropylene disk. Results have been discussed numerically and depicted graphically.

Keywords: Disk, Strain, Stress, Angular speed, Isotropic.

Paper-29

EFFECT OF VARIABLE GRAVITY ON THERMAL CONVECTION IN JEFFREY NANOFLUID WITH ANISOTROPIC POROUS MEDIUM

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ABSTRACT

In this study, we explore how varying gravity influences the initiation of thermal instability in a layer of Jeffrey nanofluid within an anisotropic porous medium. Utilizing the Darcy model for the anisotropic porous medium, we conduct a linear stability analysis employing the normal mode technique to determine the solution of the fluid layer bounded by two free-free boundaries. We derive the Rayleigh number for the onset of stationary convection using the normal mode approach. Specifically focusing on stationary convection, we analyse and visually represent the impacts of different variable gravities on

various factors, including the Jeffrey parameter, mechanical and thermal anisotropy, Lewis number, moderated diffusivity ratio, the porosity of porous media and nanoparticle Rayleigh number.
Keywords: Jeffrey nanofluid, variable gravity, normal mode technique, anisotropic porous medium.

Paper-30

THE MODIFIED ANALYSIS OF RAYLEIGH BÉNARD MARANGONI ONVECTION

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ABSTRACT

The onset of cellular convection induced by surface tension gradients and buoyancy in a horizontal layer of liquid heated from below is re-examined by using modified linear stability analysis of Banerjee et al. (J. Math. & Phys. Sci., 17, 603, 1983). This leads to a formulation of the problem which depends upon whether the liquid layer is relatively hotter or cooler. We use a combination of analytical and numerical techniques to obtain a detailed description of the marginal stability curves. Numerical results are presented. It is found that irrespective of the nature of the driving force (surface tension or buoyancy or both) the stability thresholds do significantly depend upon whether the liquid layer is relatively hotter or cooler and the results obtained are significant from qualitative as well as quantitative points of view.
Keywords: Buoyancy /Conducting /Convection /Insulating /Linear stability /Surface tension.

Paper-31

MULTIPLE EIGENVALUES of 3×3 MATRICES

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ABSTRACT

The eigenvalues of a square matrix A are the roots of its characteristic polynomial, $\det(A - \lambda I) = 0$. More appealing is the information about the eigenvalues in terms of the entries of the matrix. We show that, if the diagonal entries of a 3×3 Hermitian Matrix are all equal but the absolute values of the off diagonal entries are not equal, then the matrix A has distinct eigenvalues. Such observations in terms of the trace $(\mathrm{tr}A)$ and determinant $(\det A)$of a matrix are also equally instructive.

Paper-32

BIOMEDICAL AND HIGH FREQUENCY APPLICATIONS OF GADOLINIUM DOPED MG FERRITE

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ABSTRACT

The excellent combination of magnetic and electric of Gd-Mg ferrites can be used to fulfill the future demand for biomedical and high-frequency applications. $MgGd_xFe_{2-x}O_4$ ferrites, with improved electric and magnetic properties, are prepared by solid state reaction technique. The structural studies have been studied by using SEM and XRD. The magnetic properties such saturation magnetization, residual magnetization, cation distribution and relative loss factor have been investigated. Magnetic properties have been improved due to the doping of Gd ions in Mg ferrite. High value of magnetic moment of Gd ions may be used for biomedical applications by applying external magnetic field. High value of dc resistivity makes this ferrite more suitable for high frequency applications. The mechanisms responsible to these results have been discussed in detail in this paper.

Keywords: Ferrite; Magnetic moment; Saturation magnetization; dc resistivity

Paper-33

EXPLORING ADVANCED CALCULUS: A COMPREHENSIVE STUDY OF MULTIVARIABLE CALCULUS, VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS

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ABSTRACT

The proposed research ABSTRACT discusses the exploration of advanced calculus with regard to the topics pertinent to the study such as multivariable calculus, vector calculus and differential equations. These topics are expected to provide an in-depth study tantamount in understanding the behavior of functions and systems in multiple dimensions. Multivariable calculus extends the concepts of single-

variable calculus to functions of several variables, enabling the analysis of complex relationships and phenomena. Vector calculus deals with vector fields and their derivatives, providing a powerful tool for studying physical phenomena such as fluid flow and electromagnetism. Differential equations play a crucial role in modeling, dynamic systems and predicting their future behavior. The ABSTRACT highlights the importance of these advanced calculus topics in various fields of science and engineering and emphasizes their practical applications in real-world problems. Through this exploration, we seek to understand the fundamental concepts, applications, and significance of these branches of mathematics in various fields. Furthermore, the study also seeks to investigate the theoretical foundations, solving problems, and analyzing real-world examples to gain a comprehensive understanding of these advanced calculus topics.

Keywords: Multivariable calculus, Vector calculus, Differential equations, fluid flow.

Paper-34

ON UPPER LIMITS TO THE COMPLEX GROWTH RATE IN MULTICOMPONENT CONVECTION IN A SPARSELY DISTRIBUTED POROUS MEDIUM

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ABSTRACT

The present paper deals with the multicomponent convection in sparsely distributed porous medium. By using the Darcy-Brinkman model, it is proved analytically that the complex growth rate $p = p_r + ip_i$ (p_r and p_i are the real and imaginary parts of p, respectively) of an arbitrary neutral or unstable oscillatory disturbance of growing amplitude in multicomponent fluid layer saturating a sparsely distributed porous medium, heated from below, is located inside a semicircle in the right half of the $p_r p_i -$ plane, whose center is at the origin and radius = $\sqrt{\frac{R_1}{E_1\sigma} + \frac{R_2}{E_2\sigma} + ... + \frac{R_{n-1}}{E_{n-1}\sigma}}$, where $R_1, R_2, ..., R_{n-1}$ are the concentration Rayleigh numbers, σ is the Prandtl number, $E_1, E_2, ..., E_{n-1}$ are the positive constants. These limits are important especially when at least one boundary is rigid so that exact solutions in the closed form are not obtainable. It is further proved that the result obtain herein is uniformly valid for any combination of rigid and dynamically free boundaries.

Keywords: Multicomponent convection, Porous medium, Darcy-Brinkman model, Complex growth rate, Concentration Rayleigh number.

Paper-35

NOVEL PYTHAGOREAN FUZZY ENTROPY MEASURE FOR OPTIMAL PROJECT SELECTION USING VIKOR METHOD

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ABSTRACT

The paper addresses the intricate task of evaluating investment projects for high-grade highways, acknowledging the challenges faced by decision-makers in dealing with uncertain information. Introducing a novel methodology, it combines the entropy measure of Pythagorean fuzzy sets (PFSs) with the VIKOR method, showcasing its effectiveness through a case study. The proposed PF-VIKOR method, integrating a new entropy measure for PFSs, proves efficient in supporting the decision-making for optimal project selection.

Keywords- Pythagorean fuzzy set, Entropy measure, VIKOR, Pythagorean fuzzy number, multi-criteria decision-making.

Paper-36

THE GEOMETRY OF THE FIBRES OF A SEMI-TRANSVERSAL LIGHT LIKE SUBMERSIONS

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ABSTRACT

We introduce a study concerning a particular type of mapping called a light like submersion, which operates from a semi-transversal light like submanifold of a nearly Kaehler manifold onto an almost Hermitian manifold. We begin by defining what a semi-transversal light like submersion is and provide an example to illustrate this concept. We then demonstrate that if a certain type of almost Hermitian manifold admits a light like submersion from a semi transversal light like submanifold of a nearly Kaehler manifold, then it must itself be a nearly Kaehler manifold. Furthermore, we establish a connection between the holomorphic sectional curvatures of the two involved manifolds. Lastly, we present a theorem classifying semi-transversal light like submersions and outlining the relationship between the sectional curvatures of the main manifold and its fibers.

Paper-37

MATHEMATICAL ANALYSIS FOR SPREAD AND CONTROL OF DISEASES IN EPIDEMIOLOGY

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ABSTRACT

Mathematical modelling serves as a cornerstone in epidemiology, offering valuable insights into the transmission dynamics and control strategies of infectious diseases. This research paper provides a comprehensive examination of the mathematical analysis utilized in epidemiological studies, focusing on the fundamental principles, key equations, and relevant references shaping our understanding of disease spread and control. Through stability analysis and numerical simulations, we elucidate the significance of factors such as transmission rates, population structure, and intervention measures in shaping the epidemic trajectory.

Keywords : Mathematical modelling , epidemiology, infectious diseases.

Paper-38

THE ROLE OF MATHEMATICS IN ADVANCING PHYSICAL SCIENCES

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ABSTRACT

Mathematics serves as a powerful tool for describing the fundamental principles governing the universe, providing a common language for scientists to communicate and explore the intricacies of natural phenomena. This paper investigates the symbiotic relationship between mathematics and physical sciences, elucidating the indispensable role of mathematical tools in comprehending, modeling, and propelling our understanding of natural phenomena. From classical mechanics to quantum physics and beyond, mathematics acts as the universal language, enabling precise articulation, analysis, and prediction of physical behaviors. This presentation aims to underscore the pivotal role mathematics plays in shaping the landscape of physical sciences, fostering innovation, and propelling scientific progress.

Keywords: Mathematics, Physical Sciences, Classical Mechanics, Quantum Mechanics, Astrophysics, Cosmology, Computational Mathematics, Mathematical Modeling, Data Analysis, Simulation.

Paper-39

SOME MORE BOUNDS FOR EIGENVALUES INVOLVING ENTRIES OF HERMITIAN MATRICES.

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ABSTRACT

We obtain eigenvalue bounds of Hermitian matrices in terms of diagonal and off diagonal entries by using Cauchy's interlacing principle. Some additional bounds for second smallest eigenvalue of positive semidefinite matrices are also discussed.

Keywords- Eigenvalues, Hermitian matrix, Majorization.

Paper-40

EXPLORING MULTI-CRITERIA DECISION MAKING METHODS FOR PYTHAGOREAN FUZZY SETS: A COMPREHENSIVE REVIEW

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ABSTRACT

The Pythagorean fuzzy set (PFS) serves as an advancement beyond the Intuitionistic Fuzzy Set (IFS) by addressing its limitations. Consequently, PFS has garnered significant attention from researchers and has found application in diverse research domains. This mode of representation holds great importance in fields like pattern recognition, decision-making, and market prediction. This paper provides a comprehensive overview of frequently utilized Multiple Criteria Decision Making (MCDM) methods for Pythagorean fuzzy sets (PFS), along with an examination of the present research trends in the practical applications of PFS.

Keywords: Intuitionistic Fuzzy Set; Pythagorean fuzzy set; MCDM

Paper-41

SET OF THERMAL CONVECTION USING A JEFFREY NANOFLUID LAYER UNDER THREE DISTINCT BOUNDARY CONDITIONS

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ABSTRACT
This study examined the dynamic behaviour of thermal convection in a system augmented with a Jeffrey nanofluid layer. The Jeffrey nanofluid in particular possesses non-Newtonian features that add complexity to the fluid dynamics. In the Jeffrey nanofluid model, thermophoresis and Brownian motion effects are considered. The normal mode analysis and Galerkin type weighted residual method are used to analyze the stationary convection. Three distinct boundary conditions namely free-free, rigid-rigid and rigid-free are considered in this investigation aiming to comprehend the influence of these conditions on the instability of thermal convection. The Jeffrey parameter, Lewis number, concentration Rayleigh number and modified diffusivity ratio for all the above-mentioned boundary conditions have been examined analytically and graphically. The finding reveal fascinating insights into the interplay between nanofluid characteristics and boundary conditions in influencing the onset of stability in thermal convection.
Keywords: porous medium, nanofluid, Brownian motion

Paper-42

COMMUTATIVE BEZOUT PRIME MAXIMAL (PM) DOMAIN IN SEMIRINGS

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ABSTRACT
The aim of this paper is to study the diagonalizability for matrices over a semiring and prove that any commutative Bezout PM domain is an elementary divisor semiring.
Keywords: - Semiring, Commutative Bezout Semiring, Prime Ideal, Maximal Ideal.

Paper-43

SOME NEW CLASSES OF PERMUTATION TRINOMIALS OVER $F_{3^{2m}}$

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ABSTRACT

Permutation polynomials hold significant role in finite fields theory, and have extensive applications across various domains including coding theory, cryptography, combinatorial design, and communication theory. Notably, permutation trinomials attract researchers for their straightforward algebraic structures and remarkable properties. This paper introduces several novel classes of permutation polynomials over the finite field $F_{3^{2m}}$ presenting five distinct classes of permutation trinomials over fields with odd characteristics.

Keywords: Permutation Trinomials, Permutation Polynomials.

Paper-44

Lightlike hypersurfaces in an indefinite trans-Sasakian statistical manifold

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ABSTRACT

This research paper presents the theory of lightlike hypersurfaces for a new class of manifolds, namely indefinite trans-Sasakian statistical manifold by consolidating the notion of an indefinite trans-Sasakian manifold with a statistical structure. This geometry of these hypersurfaces has also been analyzed for the indefinite trans-Sasakian statistical manifold endowed with an (l,m)-type connection. Further, the structure of screen semi-invariant lightlike hypersurfaces within this framework has been investigated and some conditions on the recurrent and Lie recurrent structure tensor field precisely defined.

Paper-45

A WORK ON TROPICAL SUBALGEBRA OF A GIVEN TROPICAL ALGEBRA FOR NOISE REMOVAL AND OPTIMAL CONTROL

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ABSTRACT

Due to aggressive use of digital images in various fields, digital image processing become widely research oriented discussion nowadays. Therefore, it is worth considering the image restoration for the improvement of the quality of an image such as contrast adjusting, structural details, and reducing noise. Though, the images captured by digital devices are inevitably degraded by the noise during the transmission process. Many algorithms for noise removal in digital images have been proposed, over the years. It has been observed that traditional filtering methods for denoising was inefficient and complex to deal with. Recently, the use of tropical algebra to design optimal denoising algorithms has proven a noble way with advantages over traditional ones in terms of denoising efficiency and simple filtering algorithm. In this paper, we introduce the concept of maximal tropical subalgebra and analyzation of the modifications in the framework prepared for noise modelling for such tropical subalgebra are given.
Keywords: digital image processing, image denoising, tropical algebra, and denoising algorithms.

Paper-46

EXAMINING WAVELET SOLUTIONS FOR EIGHTH ORDER DIFFERENTIAL EQUATIONS

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ABSTRACT

In this study, we analyse the approximate solutions of eighth order differential equations by using the Vieta-Fibonacci wavelet approach with the operation of a derivative matrix and application of collocation method. The proposed technique depends on the truncated series approximation of an unknown function in the form of Vieta-Fibonacci wavelets. Using the proposed method, the eighth order differential equation is transformed into the system of algebraic equation which is further solved by collocation method. The novelty of the work includes the derivation of an operational matrix of derivative for Vieta-Fibonacci wavelet. Furthermore, the convergence analysis and error estimates are well covered. Key test examples are solved by the proposed approach which yields more accurate

solution in comparison to other related findings. The numerical outcomes demonstrate the accuracy as well as the efficiency of the current numerical technique.

Keywords: Vieta-Fibonacci wavelets, eighth order differential equation, operational matrix.

Paper-47

BOUNDED AND COMPACT GENERALIZED WEIGHTED COMPOSITION OPERATORS ON WEIGHTED HARDY SPACES

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ABSTRACT

The boundedness and compactness of generalized weighted composition operators on different function spaces were studied by Zhu. In this paper we have initiated the study of generalized weighted composition operators on weighted Hardy spaces. We have characterized the conditions under which the generalized weighted composition operator becomes bounded and compact.

Keywords: Generalized weighted composition operators, Bounded operators, Compact operators, Weighted Hardy spaces.

Paper-48

APPLICATIONS OF MATRICES

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ABSTRACT

Applied Mathematics will be categorized as vector Algebra, Differential Calculus, Integration, Matrices, and Determinants etc. Matrices applies to several branches of science, engineering, economics, probability theory, statistics etc. This paper present the concept of matrix and their elementary properties and its applications. Matrices are extremely helpful tools that can be found in a wide range of applications.

Matrices find many applications to practical real life problems also.

Paper-49

ELEMENTARY DIVISOR SEMIRINGS

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ABSTRACT

Using the concept of Gel'fand Semiring of range 1, we proved that a commutative Bezout domain is an elementary divisor semiring if and only it is a Gel'fand semiring of range 1. Further, we study the elementary divisor semirings for different classes of commutative Bezout domains.

Keywords: - Semiring, Commutative Bezout semiring, Gel'fand Semiring, Prime ideal, Maximal ideal.

Paper-50

VEDIC MATHS & IT'S APPLICATIONS

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ABSTRACT

Can you multiply 93 by 85 in seconds? Probably not. This is where Vedic mathematics comes in handy. Now, the question arises: What is Vedic maths? Vedic Mathematics is an ancient system of mathematical calculations and principles derived from the Vedas. It offers unique techniques and shortcuts for faster problem solving. Some of the common applications of vedica maths that can help in various fields include:

- Arithmetic Operations: Vedic Mathematics provides quick methods for performing addition, subtraction, multiplication, and division.
- Algebra: Vedic Mathematics offers alternative techniques for solving algebraic equations, simplifying expressions, and factorizing polynomials.
- Geometry: Vedic Mathematics includes techniques for solving geometric problems, such as finding areas, volumes, and angles of various shapes.
- Competitive Exams: Vedic Mathematics has gained popularity among students preparing for competitive exams like CAT and GMAT.

This is what makes Vedic maths MAGICAL -For a 2 digit by 2 digit operation answer comes in just 1 line. And even for 3 by 3 and 4 by 4 and for all kind of multiplications answers comes in just 1 line. It is obviously speedy method to get to the answer with the steps reduced, hence efficient in comparision to

conventional maths. It is a more intelligent approach to numbers: the larger the numbers, the smaller the calculations!

Efforts to promote and incorporate Vedic mathematics into the education system in India are being made, with initiatives like the Vedic Maths Forum founded in 2000 actively spreading awareness and conducting workshops for students and teachers.

Keywords: Vedic maths, swift calculations, ancient India

Paper-51

ESTIMATING THE GROWTH RATE OF PERTURBATIONS IN RIVLIN-ERICKSEN FERROMAGNETIC CONVECTION WITH MFD VISCOSITY: DARCY BRINKMAN MODEL

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ABSTRACT

The present paper analytically examines the complex growth rate in Rivlin-Ericksen Ferromagnetic convection in a sparsely distributed porous medium with MFD viscosity, heated underneath in the presence of a uniform vertical magnetic field. Through the application of Linear stability theory and Normal mode analysis, the governing partial differential equations are reduced to an Eigenvalue problem with suitable boundary conditions. The complex growth rate $\sigma = \sigma_r + i\sigma_i$ (where σ_r and σ_i are respectively real and imaginary parts of σ) of an arbitrary oscillatory motion, with a growing or neutral amplitude in the case of free-free boundaries, is found to lie in the right half of the $\sigma_r\sigma_i$ - plane within a semicircle which is centered at the origin, and its radius is given by $\sqrt{\frac{R\,M_1}{P_r\left[1+2(1+\delta M_3)F_v\pi^2\left(1+\frac{1}{\pi^2 k_o}\right)\right]}}$. Similarly, upper bounds have also been derived for the case of rigid-rigid boundaries. Pellew and Southwell's approach is successfully implemented to establish a sufficient condition for the validity of PES (Principle of exchange of stabilities) for the case of dynamically stress-free boundaries. Here R, M_1, P_r, M_3, F_v, k_o represents the Rayleigh number, Magnetic Number, Prandtl number, measure of non-linearity of magnetization, viscoelastic parameter for Rivlin-Ericksen Fluid, and the permeability of the porous medium, respectively. A detailed mathematical formulation of the problem and derivation of results are presented.

Keywords: Rivlin-Ericksen Fluid, Magnetic field, PES(Principle of exchange of stabilities), Rayleigh number, Perturbation Growth rate.

Paper-52

SORET AND DUFOUR EFFECT ON RADIATING AND VISCOUS DISSIPATING CASSON FLUID PAST A NON-LINEARLY EXPONENTIALLY STRETCHING SHEET IN THE PRESENCE OF VARIABLE MAGNETIC FIELD

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ABSTRACT

The current study focuses at examining the boundary layer flow of a Casson fluid over an exponentially permeable stretching surface with the existence of thermal radiation, magnetic field, viscous dissipation, Soret and Dufour effects. The partial non-linear differential equations of continuity, motion and energy administering the flow of problem are remodeled to the ordinary differential equations by making use of similarity transformation and figured out by utilizing MATLAB bvp4c package. On the velocity, temperature and concentration outlines, consequences of distinct non-dimensional parameters mastering the flow are deliberated and sketched with the help of graphs. There is a comparison made among the results of present study to those of the previous one which is seen to be in sound agreement. It is concluded that the Casson fluid gave better heat and mass transfer performance with the availability of the Soret and Dufour effects.

Keywords: Casson fluid, Stretching sheet, Soret and Dufour effect, Viscous dissipation, Thermal radiation.

Paper-53

HOLOGRAPHIC DARK ENERGY WITH GRANDA-OLIVEROS CUTOFF IN BRANS-DICKE THEORY

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ABSTRACT

This paper presents a detailed analysis of an interacting holographic dark energy model using the Brans-Dicke theory as a theory of cosmic evolution. To perform this analysis, we have employed the Granda-Oliveros cut-off as an infra-red cut-off. We aim to gain a comprehensive understanding of the model and its behaviour within this theoretical framework. We assume the Brans-Dicke scalar field as a logarithmic function of scale factor to discuss our model. The evolution of the universe is discussed by calculating and graphically representing the equation of state and deceleration parameter. The graphs of deceleration parameter show a smooth phase transition from medieval time deceleration to present time acceleration. It is also observed that equation of state parameter '*wh'* may cross the phantom divide line in the late-time evolution. We apply statefinder analysis to discriminate our model with existing dark energy models and found that the model shows similarity with Chaplygin gas and quintessence scalar field models. Further, we perform a detailed thermodynamic analysis, which leads us to conclude that the model satisfies the generalized second law of thermodynamics.

Paper-54

ON UPPER BOUNDS FOR THE COMPLEX GROWTH RATE OF PERTURBATIONS IN MAXWELL FERROCONVECTION IN SPARSELY POROUS MEDIUM

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ABSTRACT

In the present communication, we derive the upper bounds for the complex growth rate of an arbitraryoscillatory motion of neutral or growing amplitude inferroconvection in a Maxwell ferrofluid layer saturating a sparsely porous medium, for the cases of free-free and rigid-rigid

boundaries, respectively. It is observed that, for free-free boundaries, the possible growth rate is confined within a semicircular region in the right half $\omega_r\omega_i$ −plane, whose centre is at the origin and the radius is $\sqrt{\left\{\max\left(\frac{1}{\mathrm{k_1G}}+\frac{\mathrm{RM_1}}{\mathrm{P_r}}\right),\frac{1}{k_1G}\right\}}$.However, the possible upper bounds for the rigid-rigid boundaries is expressed as$|\omega^2||\omega_i|^2<\sqrt{\left\{\max\left(\frac{1}{k_{1G}}+\frac{RM_1}{Pr}\right)^2,\left(\frac{1}{k_{1G}}\right)^2\right\}}$,where$\omega=\omega_r+i\omega_i$ is the complex growth rate,M_1 is the magnetic number, R is the Rayleigh number, G is the stress relaxation parameter, P_r is the Prandtl number, and k_1 represents the medium permeability.

Keywords: Maxwell Ferromagnetic fluid, complex growth rate, porous medium, and viscosity.

Paper-55

ON INDEX CALCULUS ALGORITHM FOR ELLIPTIC CURVES OVER PRIME FIELD

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ABSTRACT

Security of Elliptic Curve Cryptography mainly depends on the difficulty of solving Elliptic Curve Discrete Logarithm Problem. In this paper, we propose a methodology to solve Elliptic Curve Discrete Logarithm Problem for prime field elliptic curves. The proposed algorithm solves the Elliptic Curve Discrete Logarithm Problem in such a way that it does not require Gröbner basis approach. Further, we give the complexity estimate of proposed algorithm.

Paper-56

IMPROVEMENT OF SMART CARD-BASED PASSWORD AUTHENTICATION PROTOCOL FOR TELECARE MEDICAL INFORMATION SYSTEM

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ABSTRACT

The Telecare information system (TMIS) is the most popular medical information system with notable accomplishments, because of the Internet of Things (IoT) and its recent great rise in

technology. TMIS is executed over a vulnerable public Internet, and many mutual authentication and key agreement methods have been proposed to protect the confidentiality of patients. Authentication systems, which employ Smart cards, present the optimal resolution for TMIS applications, thus ensuring both effectiveness and security. In our work, the improvement of a smart card password-based two-factor authentication scheme for telecare medical information system has been proposed. Radhakrishnan & Muniyandi scheme suffers from offline password guessing attack, impersonation attack, and smart card password changing issues. To solve these problems, we propose an improved scheme with the formation of session key security and user anonymity, which makes use of Elliptic Curve Cryptography (ECC) with smart cards, has been proposed. In this study, we have utilized the fundamental assumptions of robust and collision-resistant cryptographic Hash function, XOR function, and Elliptic Curve arithmetic. Therefore, this proposed protocol for TMIS ensures the desired security prerequisites and effectively handles the computational and communication expenses.

Keywords: TMIS, Smartcard, password authentication, ECC.

Paper-57

A COMPARATIVE STUDY OF NWCM & NECM IN TRANSPORTATION PROBLEM

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ABSTRACT

The transportation problem is a special type of LPP where the objective is to minimize the cost of distributing a product from several sources or origins to several destinations. Transportation problem deals with transport things at least cost as much as possible. The North –West Corner Method (NWCM) is the first method or way to transport things from the one corner to another corner. In this paper The North–West Corner Method and the North East Corner Method (NECM) are adopted to compute the Initial Basic Feasible Solution (IBFS) of the transportation problem. The main Objective of the study or comparison is the investigation of the minimization of the total transportation cost.

Keywords: Least Cost, NWCM, NECM; IBFS; Transportation Problem.

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Paper-58

THERMOELASTIC RESPONSE OF AXISYMMETRIC PLATE WITH CONDUCTING LIQUID

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ABSTRACT

This work investigates the axisymmetric vibrations of circular plate based on Kirchhoff-Love plate theory in contact with conducting liquid. The linear coupled thermoelasticity theory has been used to model the transverse disturbance and temperature change in the plate. Various boundary conditions for the plate have been observed. Here a formulation of the particular Eigen value problem for symmetric matrices is obtained. Rayleigh Ritz approach is used to determine the modal characteristics of a plate in contact with fluid. In this paper the analytical and numerical approaches with the help of MATLAB software are used to estimate the natural frequencies of circular plate partially in contact with liquid. Finally, the effects of various parameters and vibration modes of the system are discussed. The study may find applications in such as fluid-storage tanks, fuel tanks of space vehicles, dam-reservoir systems and naval structures.

Paper-59

ON SECOND EXTREME EIGENVALUES OF HERMITIAN MATRICES

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ABSTRACT

The bounds for the spreads of Hermitian matrices have been studied extensively in literature. We discuss here that these bounds involving positive unital linear map can also be used to study some bounds for the second smallest and the second largest eigenvalues of Hermitian matrices.

Paper-60

MATHEMATICS AND ARTIFICIAL INTELLIGENCE AS A NEW APPROACH: AN OVERVIEW

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ABSTRACT

Artificial intelligence , a technological innovation, offers educators and learners the opportunity to enhance and solve problems through better teaching and learning outcomes. This paper aims to contribute to the discussion by providing a thorough overview of artificial intelligence (AI) in mathematics instruction for learners at all educational levels. Different branches of mathematics were significantly impacted by the development of artificial intelligence. A game-changer in technology, artificial intelligence is transforming many facets of our life. The fundamental function of mathematics is what underpins the astounding developments and powers of artificial intelligence. Intelligent system creation and success are largely dependent on the use of mathematics. The framework for learning, reasoning, and making wise decisions in AI systems is provided by mathematics. In this article, we will look at the role of mathematics in artificial intelligence and its importance.

Keywords: Mathematics, Artificial intelligence, Technology.

Paper-61

CLOSED SELF-INVERSE ELEMENT GRAPH AND ITS TOPOLOGICAL INDICES

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ABSTRACT

In this paper, we exempt the condition of distinctness of vertices of the edges in the self-inverse element graph $S_i(\mathfrak{R})$ over a ring $\mathfrak{R}$. This new graph is named as a closed self-inverse element graph and denoted by $\overline{S_i(\mathfrak{R})}$. Next, the adjacency matrix of the $\overline{S_i(\mathbb{Z}_n)}$ and its eigenvalues are discussed along with the spectrum of $\overline{S_i(\mathbb{Z}_n)}$. Moreover, the different degree-based topological indices, the Randi'c index, the general Randi'c index, the atom-bond connectivity (ABC) index,

etc. are studied for $\overline{S_\iota(\Re)}$. Finally, the Gutman index and the Detour Gutman index are determined for cycle graph.

Key words: Self-inverse element, adjacency matrix, Randi'c index, general Randi'c index, Gutman index, Detour Gutman index.

Paper-62

ON A CLASS OF SELF-ORTHOGONAL AND MDS LEE DISTANCE CODES OVER FINITE RINGS

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ABSTRACT

Lee distance codes are widely used in applications such as digital communications, storage systems and satellite transmissions. In the present work, we characterize some Maximum Distance Separable (MDS) Lee distance codes and self-orthogonal codes over finite rings. Further, we construct some linear equidistant Lee codes over $\mathbb{Z}_{2^b}$, $\mathbb{Z}_{2^a p}$ and $\mathbb{Z}_p$ which have applications in error detection and error correction. In addition to this, we derive Lee distance of MDS, self-orthogonal and equidistant Lee codes.

MSC Classification: **94B05, 94B60**.

Keywords: Codeword, MDS, Self-Orthogonal, Linear Code, Equidistant.

Paper-63

Z- DERIVATIONS OF ADDITIVELY INVERSE SEMIRINGS

Madhu Dadhwal and Geeta Devi

ABSTRACT

The objective of this paper is to characterize ζ - derivations of additively inverse semirings. In the sequel, some results concerning these derivations with commutator identities are investigated and as a consequence, some conditions are proved on ζ- derivations which ensure the commutativity of semirings. In addition, we also explain how a ζ - derivation maps $\mathcal{I}$ into its center and it is proved that, if $\mathcal{D}$ is a ζ - derivation of a non-commutative prime additively inverse semiring $\mathcal{I}$ with $\zeta : \mathcal{I} \to \mathcal{I}$, an onto morphism such that $(x^2)^{\mathcal{D}} + (x)^{\mathcal{D}} x' = 0$, for all $x \in \mathcal{I}$, then $\mathcal{D} = 0$.

Paper-64

APPLICATION OF VEDIC SUTRAS IN ALGEBRA: A REVIEW

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ABSTRACT

This review paper delves into the intriguing connections between ancient Indian mathematical principles, particularly the vedic sutras, and contemporary algebraic methods. Originating from ancient vedic texts, vedic sutras are concise formulas containing profound mathematical insights. In this paper, we will closely examine the application of these sutras in the field of algebra , aiming to enhance problem – solving techniques and deepen the understanding of algebraic concepts . The investigation explores how vedic mathematics addresses challenges in elementary algebra, utilizing specific techniques challenges in elementary algebra, utilizing specific techniques such as Parvartya Yojayet, Sunyam Samyasamuccaye, Anurupye Sunyamanyat, Antyayoreva, Sankalana - Vyavakalanabhyam ,Vilokanan and Lopanasthapanabhyam . The research highlights the effectiveness of Vedic Mathematics in tackling challenges in elementary algebra through these unique techniques, offering a comprehensive exploration of their application and benefits.

Keywords: Algebra, Parvartya-Yojayet, Sunyam Samyasamuccaye, AnurupyeSunyamanya, Antyayaoreva,Sankalana-Vyavakalanabhyam ,Vilokanam and Lopanasthapanbhayam

Paper-65

AN IRREDUCIBILITY CRITERION FOR POLYNOMIALS OVER FINITE FIELDS

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ABSTRACT

Irreducible polynomials have wide range of applications in finite fields, coding theory and cryptography. Various criterion of irreducibility has been given by different researchers to

test the irreducibility of polynomials over finite fields. In the present paper, a criterion of irreducibility for polynomials with rational coefficientsover finite fields is given.
Keywords: Irreducible Polynomials, Finite Fields, Degree of Polynomial.
Mathematics Subject Classification Code: 12E05, 12E12, 12E20

Paper-66

SECURITY AND AUTHENTICITY WITH EL GAMAL CRYPTOSYSTEM

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ABSTRACT

The El Gamal system is a public-key cryptosystem based on the discrete logarithm problem. The security on the intractability is based on the hardmathematical problems, namely the finite field Discrete Logarithm Problem (DLP) and Integer Factorization Problem (IFP). Today the El Gamal algorithm is used in many cryptographic products. El Gamal Cryptosystem is used for the encryption and decryption of secret messages as well as for signing messages in order to make them authentic. This signature process aims at signing a message to ensure message authentication and integrity. In digital signature process, sender uses a signing algorithm and sent to the receiver. The receiver receives the message and signature, then applies the verifying algorithm to the combination.

Keywords: Finite Field, Secret Message, Public Key, Signing Message, Secret Key, Authenticity.

Paper-67

DOUBLE DIFFUSIVE CONVECTION IN NON-NEWTONIAN NANOFLUID POROUS LAYER WITH INTERNAL HEAT SOURCE

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ABSTRACT

The study focuses on the initiation of double diffusive convection in non-Newtonian nanofluid porous layer with the impact of internal heating utilizing modified boundary conditions. The

stationary convective stability of non-Newtonian nanofluid has been established by employing Buongiorno model for nanoparticles and Jeffrey model for non-Newtonian behavior of the fluid. The Buongiorno model incorporates the influence of thermophoresis and Brownian motion. Using infinitesimal perturbations, normal mode approach, Boussinesq approximation and linear stability analysis, the set of coupled differential equations are reduced to ordinary linear differential equation. The eigenvalue equation is solved by considering realistic boundary conditions and an analytical determination is made for the Rayleigh number equations concerning the initiation of non-oscillatory modes in terms of various non-dimensional governing factors. According to the results internal heat source parameter advances, while stationary convection is delayed due to salinity, concentration Rayleigh number and Jeffrey parameter.

Keywords: Double diffusive convection, internal heat source, Jeffrey model, porous medium.

Paper-68

SOME MATHEMATICAL THEOREMS ON ROTATORY RIVLIN-ERICKSEN FERROMAGNETIC CONVECTION WITH MFD VISCOSITY

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ABSTRACT

The present paper analytically examines the complex growth rate in Rivlin-Ericksen Ferromagnetic convection with MFD viscosity, heated underneath in the presence of a uniform magnetic field and uniform rotation about the vertical axis. Linear stability theory and Normal mode analysis are utilized to form the respective Eigen value problem for the problem under consideration. It is derived analytically that the complex growth rate $\sigma = \sigma_r + i\sigma_i$ of an arbitrary oscillatory motion with increasing or neutral amplitude, for the case of free boundaries, lies inside a semicircle in the right half of the $\sigma_r\sigma_i$ - plane, whose center is at the origin and $(\text{radius})^2 = \left[\frac{RM_1P_rT}{(1+2(1+\delta M_3)\pi^2V_i)}\right]$, where T is the Taylor number. Bounds are also established for situations involving rigid boundaries. Additionally, the "Principle of the exchange of stabilities" (PES) in Rivlin-Ericksen Ferromagnetic Convection for the case of stress-free boundaries established as $\left[\frac{RM_1P_r}{\pi^4(1+(1+\delta M_3)\pi^2V_i)}\right] \leq 1$, where R denotes the Rayleigh number, P_r represents the Prandtl number, V_i characterizes the viscoelasticity of Rivlin-Ericksen ferrofluid, M_3 is a measure of the nonlinearity of magnetization, and M_1 is the magnetic number. A detailed mathematical derivation of these findings is provided.

Keywords: Rivlin-Ericksen Fluid, Rotation, Principle of exchange of stabilities (PES), Perturbation growth rate, Taylor number.

Paper-69

MAGNETO HYDRODYNAMICS BOUNDARY LAYER FLOW AND HEAT TRANSFER OF NON-NEWTONIAN FLUID IN POROUS MEDIUM PAST AN EXPONENTIALLY STRETCHING SHEET UNDER THE INFLUENCE OF RADIATION

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ABSTRACT

The goal of the current work is to investigate the effects of the buoyancy parameter on the boundary layer flow of non-Newtonian fluid in magneto hydrodynamics across an exponentially stretched sheet in the presence of a porous medium and nonlinear thermal radiation.

The flow model of partial differential equations is converted into a set of coupled nonlinear ordinary differential equations by the use of similarity transformation. The main result of this study is that when the buoyancy parameter increases, the velocity distribution improves. Additionally, a rise in thermal radiation and thermal buoyancy causes a rise in fluid temperature.

Furthermore, it is important to observe that the fluid velocity decreases as the magnetic parameter increases. The conservative equations for mass, momentum, and energy are converted into the ordinary differential equations by using an appropriate similarity transformation. The bvp4c function in Matlab is then used to solve these equations numerically.

Paper-70

OVERSTABLE CONVECTION IN A ROTATING VISCOELASTIC NANOFLUID LAYER SATURATING IN A POROUS MEDIUM

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ABSTRACT

In the present paper we study the overstable convection in a rotating and viscoelastic incompressible, infinitely extending nanofluid layer saturating in a porous medium. The Oldroyd-B model is utilized to describe the rheological behaviour of a viscoelastic fluid. The model used for nanofluid combines the effect of Brownian motion along with thermophoresis. Using linear stability analysis and normal mode technique, the main focus is on the stationary and overstable convection for stress free boundary conditions. The explicit expressions of convective thresholds

(stationary and overstability) in terms of the control parameters of the system are obtained. The numerical computations are carried out by varying the values of different parameters, the stress-relaxation time parameter, strain- retardation time parameter, concentration Rayleigh number, Prandtl number, Taylor number and Lewis number on the stability of the system have been computed numerically. Results indicate that there was competition among the processes of thermophoresis, Brownian diffusion, angular velocity and viscoelasticity which cause oscillatory rather than stationary convection to occur. Oscillatory instability is possible with both bottom- and top-heavy nanoparticle distributions. It is found that the rotation, capacity ratio and strain-retardation parameter have stabilizing effects whereas stress-relaxation parameter, Lewis number, Prandtl number, concentration Rayleigh number and medium porosity have destabilizing effects on the viscoelastic rotating nanofluid layer saturating in a porous medium.

Keywords: Viscoelastic nanofluids, Brownian motion, Thermophoresis, Angular velocity.

Paper-71

CONSTRUCTION OF NOVEL CLASSES OF PERMUTATION BINOMIALS AND TRINOMIALS OVER $F_{2^{2k}}$

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ABSTRACT

Permutation polynomials play crucial role in various engineering and scientific domains. Distinguished by their concise structure, permutation binomials and trinomials have applications in cryptography, coding theory, and combinatorial designs. This paper presents the construction of new classes of permutation binomials and trinomials, specifically of the form $x^r(x^{2^{2k-1/d}})$, within the finite field $F_{2^{2k}}$. By investigating different values of d, our aim is to enrich the field of permutation polynomials.

Keywords: Permutation polynomial; Permutation binomial; Permutation trinomial.
AMS Subject Classification: 11T06; 06E30; 94A60

Paper-72

MATHEMATICAL MODEL FOR THE ANALYSIS OF CO-INFECTION OF TUBERCULOSIS AND SCRUB TYPHUS

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ABSTRACT

Tuberculosis is one of the burning issues of the modern era that have caused serious health hazard in human body in the last few decades. Also, scrub typhus poses a serious risk in the Himalayan regions. The coexistence of tuberculosis and scrub typhus as a concurrent infection can poses a significant and concerning danger to the human population. The main focus of the work is to develop a mathematical model to understand the dynamics of co-infection of tuberculosis and scrub typhus. In this study, we formulated an SEIR model and derived the related fundamental properties. Firstly, we analysed tuberculosis and scrub typhus sub models, and co infection model, then calculated their basic reproduction numbers using next generation matrix approach and investigated the existence and local stabilities of equilibriums using Routh-Hurwitz stability criteria. It is demonstrated that in the absence of disease, tuberculosis and scrub typhus sub models exhibit local asymptotic stability provided the basic reproduction number is less than one. Moreover, co-infection model also exhibited local stability in the disease-free scenario, provided that the basic reproduction number is less than unity. The global stability of the coinfection model at the disease free equilibrium is also studied. Additionally, we investigated the phenomenon of backward bifurcation in the co-infection model where sensitivity analysis for the model parameters is also performed. To demonstrate and support the analytical result of the study, some numerical simulations were performed. Overall findings indicate that reducing the contact rate is significant in bringing down the number of tuberculosis and scrub typhus co-infected infectious population.

Keywords: Tuberculosis, Scrub typhus, Co-infection, Reproduction number, Backward bifurcation.

Paper-73

A REVIEW PAPER ON WHEN THE CAUCHY INEQUALITY BECOMES A FORMULA

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ABSTRACT

In this research paper we revisit the classical geometric-arithmetic mean inequality and find a formula for the difference of the arithmetic and the geometric means of given $n \in N$ non-negative numbers $x_1, x_2, x_3, \ldots \ldots \ldots \ldots \ldots \ldots \ldots x_n$. This new formula provides stronger version to geometric-arithmetic mean inequality and also the case of equality discuss. At the end of this research paper it shows that all the inequalities are optimal in some sense.

Keywords: Arithmetic, Geometric, Optimal, Brunn-Minkowski Inequality, Bernoulli Inequality etc.

Paper-74

MATHEMATICAL UNDERSTANDING OF THE SCRUB TYPHUS DISEASE AMONG THE HIV PATIENTS

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ABSTRACT

Human Immunodeficiency Virus (HIV) is a deadly infection that has been spreading throughout the human population as an epidemic for a few decades. Scrub typhus, on the other hand, is a major zoonotic disease in the northern regions of India. The health of individuals affected by both HIV and scrub typhus has significant deterioration. In this work, a mathematical model of SIR-type is developed to illustrate the dynamics of co-infection with HIV and scrub typhus. Here, we demonstrated the non-negativity and boundedness of the solutions within the co-infection model. The sub models of HIV and scrub typhus are first investigated independently, and then the dynamics of the co-infection model is examined. Using the next generation matrix approach, we computed the basic reproduction number. The local and global stability of the co-infection model at the disease-free equilibrium is thoroughly investigated. Furthermore, the suggested model

showcased the phenomenon of backward bifurcation using the Center Manifold criteria. To validate the data, numerical simulation is performed. The significance of model parameters in the dynamics of the disease is determined by sensitivity analysis. The collective findings indicate that in order to stop the spread of disease, control measures can be put in place to reduce the number of people infected with scrub typhus, the population of mites, and the low rate of human to human transmission of the HIV virus.

Keywords: HIV, Scrub typhus, Co-infection, Mathematical model, Reproduction number, Stability analysis, Bifurcation analysis.

Paper-75

INVESTIGATION OF ROTATING MAGNETIC NANOFLUID FLOW ON A VERTICALLY MOVING DISK WITH VARIABLE THERMAL CONDUCTIVITY

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ABSTRACT

The significance of rotating magnetic nanofluid on discs has a broad range of engineering and healthcare applications like monitoring blood flow, improving drug delivery, creating frictionless seals and enabling magnetic coupling in rotating disk systems. The objective of this research is to examine the magnetic nanofluid flow on a vertically moving rotating disk under unsteady conditions, considering variations in thermal conductivity. The fundamental concept of the Neuringer–Rosensweig (NR) framework has been incorporated into the equations governing motion. A method of similarity transformation is utilized to adjust the momentum and energy equations, resulting in a set of interconnected non-linear differential equations with significant dimensionless physical parameter. The numerical solution for the transformed system is computed using the bvp5c solver in MATLAB R2023a. The graphical and tabular depictions are utilized to illustrate the numerical outcomes. The azimuthal velocity exhibits an inflection point influenced by both rotation and upward motion. The temperature profiles for both MNF FC-72 and EMG-901 display a decreasing trend, which becomes more pronounced with an increasing FHD interaction parameter. In conjuction, skin friction decreases with vertical motion parameter for injection and increases for suction.

Keywords: Rotating disk, magnetic nanofluid (MNF), vertical moving disk, variable thermal conductivity.

Paper-76

MACHINE LEARNING MODELS FOR STOCK MARKET: A COMPARATIVE STUDY

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ABSTRACT

The precise forecast of stock priced remained a complicated and serious challenge in the constant changing panorama of fiscal marketplaces. Since the time line data are non-linear and highly instable in nature, stock market mandates to have sophisticated prediction tools. This studied explored the various supervised machine learning models to enhance the understanding and precise forecasting of current stock values in the stock market. Comparison between two models namely Support vector machine and Long Short-Term Memory models was drawn and the evaluation is carried out on the basics of its performance and efficiency in stock prediction. The outcomes of the comparison depicted that Support Vector Machine delivered better performance as compared to Long Short-Term Memory model.

Keywords: Support Vector Machine, Long Short-Term Memory, Stock Market, Prediction, Machine Learning.

Paper-77

MODELLING OF TYPHOID FEVER DISEASE WITH NONLINEAR INCIDENCE RATE

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ABSTRACT

Typhoid fever remains a pressing global health issue, especially in areas with poor sanitation and healthcare systems. Mathematical models are essential for understanding how typhoid spreads and for assessing the ways to control it. Our study introduces a mathematical model that captures the transmission dynamics of typhoid, incorporating a nonlinear incidence rate to measure how the disease spreads. This model, known as the SCIRB model, reveals two important states disease-

free equilibrium and endemic equilibrium. By calculating the reproduction number Ro, we determine whether the disease-free state is stable Ro < 1 or if the disease is endemic Ro > 1. We also explore the type of bifurcation analysis that occurs with the nonlinear incidence rate, using the Castillo-Chavez and Song method. Our findings show that when Ro = 1, there's a shift from disease-free to endemic equilibrium. We consider how the infectiousness of individuals changes as they get infected, making our model more realistic. We study how different factors affect disease spread, accounting for nonlinear incidence in typhoid transmission modeling and offering valuable insights for policymakers working to reduce the impact of this disease through simulations and sensitivity analysis.

Keywords: Typhoid fever, Reproduction number, Sensitivity analysis, Forward bifurcation.

Paper-78

A NOTE ON NARAYANA-LUCAS HYBRINOMIAL SEQUENCE

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ABSTRACT

In the present research paper, we introduce the Narayana-Lucas hybrinomial sequence and analyse this sequence in the context including the recurrence relation, matrix representation, generating function, Binet's formula, exponential generating function, and Poisson generating function. In addition, we provide some well-known identities, including the Catalan identity, the Cassini identity, the d'Ocagne identity, the Gelin-Cesaro identity, and the Melham identity, related to this newly formed sequence. Finally, we also provide the source Maple 13 code for the validity of the occurrence of this newly formed sequence.

Keywords: Narayana sequence, Hybrinomial sequence, Generating functions, Recurrence relations

Paper-79

VIBRATION ANALYSIS OF VISCO-ELASTIC TRAPEZOIDAL PLATE WITH THICKNESS VARIES LINEARLY IN ONE AND PARABOLICALLY IN OTHER DIRECTION

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ABSTRACT

In this paper, the present analysis demonstrates the thermal effect on vibrations of a symmetric, non-homogeneous trapezoidal plate with varying thickness in two directions i.e. linearly in one and parabolically in other direction is presented. The thickness variation in two-direction is taken as the Cartesian product of linear variation and parabolic variation along the two concurrent edges of the plate in x- direction and y-direction respectively. Also, it is considered that the plate have clamped boundary conditions on all the four edges. The Rayleigh-Ritz technique has been used to get the required frequency equation. In the present investigation, the effect of various factors i.e. taper constants and aspect ratio are studied to find the values of logarithmic decrement, time period and deflection for the first two modes of vibration.

Keywords: Visco-elastic, vibration, rectangular plate, thickness variation, linearly, Parabolically, Aspect ratio.

Paper-80

EXPLORING RHOTRIX MODULES : INSIGHTS AND OBSERVATION

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ABSTRACT

In this paper, we articulate the formulation of modules over the rhotrix ring. We demonstrate that a set of 3-dimensional rhotrices, incorporating a heart element from an arbitrary ring module, constructs a module when subjected to rhotrix addition and multiplication based on the heart element. Furthermore, we delve into characterizing submodules within rhotrix modules and provide a detailed exploration of maximal submodules, accompanied by relevant examples .Additionally, the paper introduces the concept of quotient rhotrix modules for a comprehensive understanding of the subject.

Keywords: Rhotrix, Rhotrix ring, Modules over ring, Submodules, Maximal submodule, Quotient modules.

Paper-81

A NON-REDUCIBLE CHUA-LING LIKE ELLIPTIC CURVE CRYPTOSYSTEM

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ABSTRACT

Elliptic curve cryptography is used nowadays for many security goals because it can provide better security in small bit key size as compared to other schemes. In this paper, we review the chua-ling cryptosystem and provide our new scheme to extend its security.

Paper-82

HIGHER ORDER OLIVIER AND OLIVIER-LUCAS QUATERNIONS

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ABSTRACT

In this paper, we establish the concept of higher-order Olivier and Olivier-Lucas quaternions by utilizing higher-order Olivier and Olivier-Lucas numbers. Initially, we introduce Olivier and Olivier-Lucas numbers for higher orders, and then we define quaternions for higher-order Olivier and Olivier-Lucas numbers. After that, we define Binet's formula, generating function, and exponential generating function for these newly introduced numbers. Additionally, we provide various identities, including Cassini's identity, Catalan's identity, and Vajda's identity for the same.

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Paper-83

INDIA EXPLORING KATAPAYADI IN MODERN DATA COMPRESSION TECHNIQUES

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ABSTRACT

This paper investigates the usability of KATAPAYADI, ancient vedic period, in the encryption of plain Devnagri text. The Katapayadi system involves encoding numbers into alphabets, acting as a form of simple cryptography. Its origins are unclear, with some attributing it to Vararuci, a scholar

from Kerala in the fourth century CE. Its extensive use continued in the works of mathematicians and astronomers in Kerala from the 14th to the 18th century CE, showing its enduring legacy. Here we take modified Katapayadi method as the ancient Indian method of text encryption and decryption and based on the same algorithms for the encryption and decryption of plain Devnagri text is proposed. The developed algorithms are presented with examples and possibility of its use in steganography and text to numbers transformation are also discussed.

Keywords: Katapayadi, Vedic, Encryption and decryption.

Paper-84

WHEAT YIELD PREDICTION USING MACHINE LEARNING IN PUNJAB REGION

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ABSTRACT

One of the most important sectors for the growth of any country is agriculture. It has an influence on global food grain statistics in addition to the country's economy. Agriculturists always face challenges in achieving sustainable agricultural production. Because of the constantly shifting climatic circumstances, farmers have always faced challenges in achieving optimal agricultural yields. Predicting crop yields is a crucial part of agriculture. Planners and farmers alike may benefit

greatly from the timely and accurate crop output forecasts when making decisions. One such area of study is crop production prediction based on crop, soil, water, and environmental characteristics. When investigating nonlinear interactions that are hidden from view, machine learning (ML) techniques outperform traditional statistical methods. Using machine learning tools and meteorological data from the Punjab area, the research seeks to predict wheat yield in this particular setting. In order to predict the wheat crop output in the northern area of India, an Artificial Neural Network (ANN) model based on machine learning is used in this study. Other machine learning models were also used in this study to solve the issues. The outcomes of the suggested model will be examined. Experiments were carried out utilizing the benchmark dataset from the preceding 15 years. The metrics used to check model performance are root mean squared error (RMSE) and mean absolute error (MAE).

Keywords: Machine learning, Crop yield, ANN and Agriculture.

Paper-85

ANALYSIS OF THERMOELASTIC VIBRATIONS OF A NONLOCAL MICRO/NANO SCALE BEAM WITH VOIDS VIA THREE PHASE LAG MODEL

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ABSTRACT

Analysis of thermoelastic vibrations of micro and nano-beam resonators plays a very important role in designing the resonator with high-quality factors. This paper, develops a mathematical model for a homogeneous isotropic, porous, nonlocal thermoelastic beam using the three-phaselag theory of thermoelasticity. To account for small-scale effects, the governing equations for the transverse vibrations of voided nonlocal micro/nano thermoelastic beam have been derived using Euler-Bernoulli theory. Temperature and void volume fraction fields along the thickness direction of the beam are also obtained. Utilizing the solutions for time harmonic vibrations of the beam, precise expressions for key distributions, such as deflection, temperature, equilibrated stresses are derived with nonlocal effect. The both ends of the beam are studied under three distinct boundary conditions: clamped-clamped (CC), simply supported (SS), and clamped-free (CF). These analyses consider various practical engineering applications and contribution in area utilizing NEMS/MEMS devices, due to its high sensitivity and quick reaction feature.

Keywords: Micro/Nanobeam, thermoelastic vibrations, nonlocal elasticity, three-phase-lag, voids

Paper-86

NON-LINEAR EVOLUTION MODEL ON CAFFEINE CONSUMPTION BEHAVIOR UNDER CAPUTO-FABRIZIO DERIVATIVE

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ABSTRACT

Nowadays, we observe the direct and indirect intake of caffeinated items has increased to manage the modern lifestyle. Numerous research studies have demonstrated the amount of caffeine and its various effects on the human body due to its addiction. Motivating by the SMR model proposed by Fang Jin, et al for analyzing the drinking behavior of various individuals through the fractional drinking problem, we check the dynamical behavior of the caffeine-consuming population by using the special non-singular kernel and the Caputo-Fabrizio (CF) arbitrary order operator to construct a model on caffeine consuming population using fractional calculus.

Keywords: Caputo-Fabrizio operator, Non-singular kernel, Caffeine-consuming population, Fractional calculus.

Paper-87

CONVECTIVE INSTABILITY IN A HOT FERROFLUID LAYER WITH PERMEABLE BOUNDARIES UNDER THE EFFECT OF MAGNETIC FIELD DEPENDENT VISCOSITY

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ABSTRACT

Keeping in view the pervasive implications of permeable boundaries across various disciplines, the present paper emphasizes the thermomagnetic convection phenomenon within a confined ferrofluid layer heated underneath, where confinement is governed by permeable boundaries. This investigation is performed in the presence of a uniform vertical magnetic field and accounts for variations in viscosity due to the magnetic field. The eigenvalue problem is formed by using linear stability theory and normal mode analysis. By employing the single-term Galerkin method, we

investigate the threshold value of the convective instability parameter for the stationary mode and for different combinations of boundary conditions. Numerical computations and graphical representations are employed to analyze the effect of magnetic field-dependent (MFD) viscosity δ and magnetic parameter M_1 and M_3 on the onset of stationary convection for each possible combination of boundary conditions. It is perceived that the system exhibits stronger stabilization against ferromagnetic convection when the permeability of the boundary layers is at its minimum, accompanied by larger δ values. For the case where permeable boundaries exhibit dissimilar characteristics, specifically when the permeability of the upper boundary varies inversely to that of the lower boundary, a specific range of permeability parameter K is obtained and within this range, the permeability parameter manifests a destabilizing influence on the onset of ferroconvection. Additionally, the dual role of parameter observing the non-linearity of fluid magnetization (M_3) is noted. The results documented in prior research are derived as special cases from the findings of the current study.

Keywords: Convection, Ferrofluid, MFD viscosity, Permeable, Stability analysis.

Paper-88

RELATIVISTIC MEAN FIELD MODELS AND THE EQUATION OF STATE OF MASSIVE NEUTRON STARS

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ABSTRACT

This study focuses on constraining the behavior of asymmetric dense matter (unequal numbers of protons and neutrons) at high densities. We consider the heaviest observed neutron star, PSR J0952-0607, with a mass of Mmax = 2.35±0.17 M⊙ (solar masses). Additionally, we take into account the properties of finite nuclei and bulk nuclear matter. We propose four new interactions within the relativistic mean field model. These interactions incorporate various combinations of couplings (forces) between different meson fields: the isoscalar-scalar (σ), isoscalar-vector (ω), isovector-vector (ρ), and isovector-scalar (δ) mesons. These couplings can be non-linear, self-interacting, or cross-interacting, and extend up to the fourth power of the meson fields. Importantly, these interactions are consistent with the properties of both finite nuclei and bulk nuclear matter. Our analysis reveals that interactions involving couplings between the δ meson and nucleons significantly impact the slope of the symmetry energy (L), the radius (R1.4), and the dimensionless tidal deformability (Λ1.4) of a typical neutron star. Furthermore, we predict that the radius of a 2.08 M⊙ neutron star lies within the range R2.08 = 12.98–13.34 km, which aligns with observations from the NICER instrument reported by Miller et al. (2021).

Paper-89

CONSTRUCTION OF ZNIN2S4 BASED S-SCHEME HETEROSTRUCTURES FOR DEGRADATION OF TOXIC POLLUTANTS

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ABSTRACT

The development of $ZnIn_2S_4$-based S- scheme ternary heterostructures are designed as visible light photocatalysts for water purification applications was the main focus of the research effort that was presented. One such model pollutant that has been used is Rhodamine B. The produced photocatalyst was characterized using sophisticated spectroscopic methods. Furthermore, the

photocatalytic capabilities of the photocatalysts were ascertained through the utilization of electrochemical impedance spectra, photoluminescence, Tauc plots, and photocurrent response. The recently produced materials were used in photocatalysis to eliminate harmful contaminants from water-based solutions. The kinetics of Rhodamine B's degradation have been studied using it as a model pollutant.

Paper-90

A CLOSE SYMBIOSES OF MATERNAL-FETAL RELATIONSHIP THROUGH THE BOUNDARIES OF DIFFERENTIAL EQUATIONS: AN OVERVIEW

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ABSTRACT

The present research paper explores the applications of differential equations in pregnancy research highlighting the potentiality to enhance our understanding of the physiological processes that occur during gestation. Pregnancy is a complex and dynamic process that involves a series of

intricate physiological changes and interactions between the maternal body and the developing fetus. Underscoring the mechanisms of these changes is crucial for ensuring optimal maternal and fetal health outcomes. Numerous equations have emanated as a powerful mathematical tool for modeling and analyzing various aspects of pregnancy triggering a quantitative framework to study the dynamics of fetal growth, hormonal regulation, uterine contractions and blood flow dynamics. The use of differential equations in pregnancy research offers a unique opportunity to gain insights into the complex interplay of biological processes that shape the course of gestation. By developing mathematical models based on differential equations researchers can simulate and analyze the dynamics of fetal growth and development, providing valuable information for monitoring fetal well-being and predicting potential complications. These models can also help to elucidate the hormonal changes that occur during pregnancy, shedding light on the regulatory mechanisms that influence maternal physiology and fetal development.

Keywords: Pregnancy, Fetal growth, Hormonal changes, Uterine contractions, Blood flow dynamics, Differential equations.

Paper-91

OPTIMAL CONTROL ANALYSIS FOR THE TRANSMISSION OF VARICELLA ZOSTER VIRUS IN INDIA

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ABSTRACT

Varicella commonly known as chickenpox is characterized as an acute and immensely transmissible illness that is induced by the varicella zoster virus (VZV), a constituent of the herpesvirus family**.** Varicella is a prevalent illness experienced during childhood distinguished by elevated body temperature, the presence of viral particles in the bloodstream, and the appearance of dispersed blistering eruptions on the skin. After infection, the virus stays latent in the brain neurons and reactivates in 10–20% of instances to develop herpes zoster, or shingles, which typically affects those over 50 years of age or those with impaired immune systems. Therefore in the present study, we developed a deterministic SEIR(Suspectible-Exposed-Infected-Recovered) mathematical model of varicella transmission in the human population in India. Initially, the primary qualitative analysis, such as the disease-free equilibrium point (DFEP), basic reproduction number, equilibrium point stability analysis, and sensitivity analysis are thoroughly examined. Then the basic model is enhanced with time-dependent control factors to create an optimal control

model for the disease and derive the necessary conditions for the optimal control of the disease. The numerical simulations indicate that the integrated strategy is highly effective in controlling the spread of Varicella zoster virus (VZV) in India.

Keywords: Varicella, SEIR mathematical model, Stability Analysis, Sensitivity Analysis, Optimal Control

Paper-92

EFFECT OF MAGNETIC FIELD DEPENDENT VISCOSITY ON FERROCONVECTION IN A POROUS MEDIUM WITH PERMEABLE BOUNDARIES

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ABSTRACT

In the present paper, we study the convective instability of a ferrofluid layer saturated in a sparsely distributed porous medium confined between two horizontal permeable boundaries heated from below and is exposed in a vertically applied uniform magnetic field. A single-term Galerkin technique has been used to solve the eigenvalue problem and Rayleigh number is calculated for various boundary conditions. The impact of crucial factors, such as magnetic field-dependent (MFD) viscosity parameter, magnetization parameters, porosity of the porous medium permeable boundary parameters on the onset of stationary convection, is investigated through numerical calculations and graphical representations in this study. The findings indicate that the MFD viscosity exerts a stabilizing influence on the system, while the porous medium's porosity destabilizes it. Moreover, a destabilizing impact occurs in the system when the permeability of the upper boundary is inversely proportional to the permeability of the lower boundary.

Keywords: Ferrofluid, Thermal Convection, Porous Medium, Galerkin Method.

Paper-93

UNSTEADY FLOW AND HEAT TRANSFER OF A COMPRESSIBLE HYDROMAGNETIC FLUID THROUGH A DISK OF FINITE RADIUS

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ABSTRACT

Fluid dynamics and heat transfer are essential for various engineering applications, ranging from aerospace to energy system designs. Understanding how compressible hydromagnetic fluids behave near solid surfaces is crucial for optimizing design and performance. This study investigates the unsteady flow and heat transfer characteristics of such fluids as they interact with a finite-radius disk. This two-dimensional scenario considers a compressible hydromagnetic fluid that flows past a stationary disk of finite radius. The fluid is subjected to a magnetic field, and its compressibility effects are significant. The disk represents a typical geometry encountered in rotating machinery, heat exchangers, and boundary layer flows. The objective is to analyze the velocity field, temperature distribution, and heat transfer rates near the disk surface under unsteady conditions. Existing research on hydromagnetic flow and heat transfer primarily focuses on incompressible fluids or idealized geometries. However, the behavior of compressible hydromagnetic fluids near finite-radius disks remains relatively unexplored. Additionally, the interaction between the magnetic field and compressible fluid dynamics necessitates specialized analysis. This research bridges the gap in understanding the complex interaction between compressible hydromagnetic fluids and finite-radius disks. By addressing unsteady effects and considering compressibility, the study aims to enhance our knowledge of fluid-disk interactions and contribute valuable insights to fluid dynamics and engineering practice.

Keywords: Unsteady flow, heat transfer, compressible fluid, hydromagnetic, finite-radius disk, two dimensions.

Paper-94

THERMOSOLUTAL INSTABILITY ANALYSIS OF ROTATING VISCOELASTIC FLUID IN A POROUS MEDIUM

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ABSTRACT

Thermosolutal instability occurs when the density change in the fluid depends upon two factors temperature and salt. It has a large number of applications in oceanography. In this paper we study thermosolutal instability of a compressible Walters' (model B′) fluid flowing through a porous medium and find the impact of rotation on it. Here we use Darcy model to investigate the fluid flow through porous medium. The problem has been modeled by using the constitutive equations provided by Walters'(1962). By using normal mode analysis we find the dispersion relation which shows the effect of different non-dimensional parameters on the system. The dispersion relation has been analyzed numerically and the results thus obtained have been presented graphically. We find that rotation has a stabilizing effect on the thermosolutal instability of Walters' (model B′) viscoelastic fluid. Here we also find the impact of compressibility, solute gradient and medium permeability on the above mentioned system.

Keywords: Thermosolutal Instability, Viscoelastic fluid, Compressibility, Porous Medium, Medium Permeability.

Paper-95

A HYBRID AUTHENTICATED IMAGE ENCRYPTION SCHEME USING ELLIPTIC CURVES FOR ENHANCED SECURITY

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ABSTRACT

The rapid evolution of digital technology has heightened concerns about the security of multimedia communication across vulnerable platforms. In response to this challenge, our research introduces a comprehensive encryption and authentication framework tailored for both grayscale and color images. Central to our approach is the incorporation of the Elliptic Curve Diffie-Hellman (ECDH) key exchange method, complemented by the Fibonacci matrix and enhanced modified logistic maps. Furthermore, we present an asymmetric variant of the Affine-Hill cipher, designed specifically for block-based image encryption to ensure superior cipher image quality. A pivotal aspect of our methodology is the generation of a self-invertible key matrix and a shift Fibonacci matrix derived from the ECDH session key. This matrix, combined with two distinct one

Dimensional (1D) modified logistic maps, efficiently scramble the original image pixel positions. To enhance the scheme's security, a novel authentication mechanism is incorporated, integrating a digital signature with the cipher image. Our Python 3-based implementation showcases the resilience of the proposed framework against a spectrum of attacks, as evidenced by rigorous evaluations of parameters such as correlation, entropy, variance, execution time, and key space. Through comparative analysis with recent encryption methodologies, we highlight that our approach is effective, robust and secure.

Paper-96

THE CURRENT STATUS AND FUTURE POTENTIAL OF RENEWABLE ENERGY IN INDIA

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ABSTRACT

India has made significant strides in renewable energy development in recent years, with the government setting ambitious targets for increasing the share of renewables in the energy mix. We discusses the various renewable energy sources being utilized in India, such as solar, wind, biomass, and hydropower, and analyzes the progress made in each sector. It also highlights the challenges faced by the renewable energy sector in India, including policy and regulatory bottlenecks, financial constraints, and infrastructure limitations. Despite these challenges, the paper argues that India has immense potential for renewable energy development, given its abundant natural resources and growing energy demand. It concludes with recommendations for policymakers to further advance the renewable energy sector in India and achieve the country's clean energy goals. Overall, it demonstrates that renewable energy has a bright future in India and can play a significant role in meeting the country's energy needs sustainably. This is evident from the growth of renewable energy sources in recent years, the increasing government support, and the potential for further development in sectors such as solar and wind power. We highlight the challenges that need to be addressed in order to fully realize the potential of renewable energy in India. These include policy and regulatory barriers, financial constraints, and the need for infrastructure development and technological advancements. However, the paper provides examples of successful renewable energy projects and initiatives that show progress is being made in overcoming these challenges.

Keywords: Biomass; Geothermal; Hydropower; Solar Power; Tidal Power; Wave Power; Wind Energy.

Paper-97

CHARACTERIZATION OF THE NON-OSCILLATORY MOTION IN DARCY-BRINKMAN CONVECTION IN A POROUS MEDIUM SATURATED WITH A BINARY VISCOELASTIC FLUID

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ABSTRACT

The paper mathematically establishes the principle of the exchange of the stabilities in binary viscoelastic fluid saturated porous medium (Darcy brinkman model) and is valid for $\frac{P_r R_T \lambda}{\pi^2} + \frac{\chi R_S P_r {L_e}^2}{\pi^4} - \varepsilon \leq 1$ where R_T is Darcy-Rayleigh number, λ is Relaxation parameter, P_r is Darcy-Prandtl number, χ is normalized porosity, ε is retardation parameter R_s is solute Rayleigh number and L_eLewis number. The result is valid for free and rigid boundaries

Keywords: Double-diffusive convection. Viscoelastic fluid. Porous layer. Heat mass transfers.

Paper-98

MODELLING OF TYPHOID FEVER DISEASE WITH A NONMONOTONIC INCIDENCE AND SATURATED TREATMENT RATE

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ABSTRACT

Typhoid fever remains a significant public health concern in many tropical developing countries due to its endemic nature. We propose and analyse a compartmental SCIR nonlinear deterministic mathematical model for the typhoid fever outbreak with varying populations. We introduce the nonmonotonic incidence rate and saturated treatment rate for the typhoid disease. The model uncovers two significant states: the disease-free equilibrium and the endemic equilibrium. The basic reproductive number, which serves as a key indicator of epidemic potential, is calculated by extracting the largest eigenvalue from the next-generation matrix. Stability conditions, both locally

and globally, for the disease-free equilibrium are established through this process. Additionally, sensitivity and bifurcation analyses are performed to explore the behaviour of the pertinent parameters. Numerical simulations are carried out to establish the effect of model parameters on spread of disease.

Keywords: Typhoid fever, Reproduction number, Nonmonotonic Γ-incidence, Saturated treatment.

Paper-99

ECONOMY AND MANAGEMENT

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ABSTRACT

In the realm of economics and management, the dynamics of resource allocation, decision-making, and organizational behavior intersect to drive the functioning of businesses, industries, and economies. The economy encompasses the production, distribution, and consumption of goods and services within a society, while management involves the coordination of resources and people to achieve organizational goals effectively and efficiently.Effective management involves strategic planning, organizing resources, leading teams, and controlling processes to optimize performance and achieve desired outcomes. It encompasses various functions such as human resource management, operations management, financial management, marketing management, and strategic management. In a constantly evolving business environment, managers must adapt to changes in technology, market trends, regulatory frameworks, and consumer preferences to maintain competitiveness and sustain growth. Understanding economic principles is crucial for managers to navigate market dynamics, anticipate demand, manage costs, and make informed decisions that maximize value creation and profitability. Economic concepts such as supply and demand, elasticity, market structures, inflation, unemployment, fiscal policy, monetary policy, and international trade influence business strategies and operational decisions. Moreover, the interplay between economic forces and managerial practices shapes the broader socio-economic landscape, impacting employment levels, income distribution, wealth accumulation, and overall standards of living. Effective economic policies and management practices can foster sustainable economic growth, mitigate risks, and promote socio-economic development.

Keywords: Economy, Management, Decision-making, Strategic planning, Socio-economic development.

Paper-100

DETAILED ANALYSIS OF HIV – HEPATITIS B CO-INFECTION MODEL WITH OPTIMAL CONTROL

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ABSTRACT

The human population is suffering from the deadly Human Immunodeficiency Virus (HIV) since last several decades and is rapidly spreading. On the other hand, hepatitis B virus (HBV) is also a major global public health concern. HIV patients frequently have hepatitis B infection due to the similar viral transmission mechanisms of HIV and hepatitis B. People who test positive for HIV and hepatitis B have seen a significant decline in their health. In this work a mathematical model of the SIR-type to show the dynamics of co-infection with HIV and hepatitis B is developed. The non-negativity and boundedness of the co-infection model are also ensured. Following an independent study of the HIV and hepatitis B sub models, the dynamics of the co-infection model is examined in detail. Our method of computing the basic reproduction number is the next generation matrix approach. The local and global stability of the co-infection model at the steady state is thoroughly investigated. Using numerical simulations for the optimal control problem, the most efficient method to reduce the spread of HIV and hepatitis B co-infection in the community, is to apply all the potential protection and treatment strategies together.

Keywords: HIV, Hepatitis B, Co-infection, Mathematical model, Reproduction number, Stability analysis, Optimal control, Numerical simulation.

Paper-101

A SUFFICIENT CONDITION FOR THE METRIZABILITY OF OF CONE METRIC SPACES OVER TOPOLOGICAL GROUPS

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ABSTRACT

The main objective of the paper is to show that the recently introduced cone metric spaces over topological modules are metrizable in most cases. We have proven the result as a corollary of a more general theorem for cone metric spaces over topological groups. The paper provides a very general and easy to verify condition for the metrizabilty of a large class of generalizations of metric spaces that have appeared during the last decade. We have also given an example to show that the condition is not necessary.

Paper-102

VIRTUAL VOYAGES: ENHANCING PHYSICS EDUCATION THROUGH SIMULATION FOR UNDERSTANDING AND OBSERVING STUDENT LEARNING PATTERNS

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ABSTRACT

Simulations can provide elements of learning experiences by offering hands-on and interactive environments where learners can apply theoretical knowledge, make decisions and can see the outcomes in a safe and controlled setting. This practical engagement leads to better retention, understanding and skill development to its users. These simulations are beneficial not only to the teaching fraternity but also aids students as a key tool for better understanding of their respective subjects. Teachers can use simulation tools to refine their skills or to explore future possibilities in their domains. Students on the other hand can use simulations to gain practical experience, understand complex concepts and to build foundational skills in a risk-free and user-friendly environment.

The paper highlights the use of MIT Atomic-Scale Modeling Tool Kit provided by NanoHUB.org. NanoHUB platform provides an excellent opportunity to meet goals of conceptual understanding and developing cognitive skills for exploring new concepts and problems in physics and other related subjects. The paper is based on the findings of using different simulation tools from NanoHUB platform of the material sciences. It also explains successfully how NanoHUB resources can be integrated into teaching process and how students perceive different dimensions of NanoHUB as simulation tool. Hence, the present paper aptly sums up the two-way approach of incorporating the simulation tools in teaching courses and student's response to this learning experience.

Keywords: Simulations, Atomic-Scale, NanoHUB, Simulation tools, Material science.

Paper-103

MACHINE LEARNING ALGORITHMS: A REVIEW

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ABSTRACT

Machine Learning is a prevalent subarea of Artificial Intelligence which helps the system to learn and also equips it with the power to perform specific tasks and take decisions by itself without being explicitly programmed. In Machine Learning the system learns from present data and also from the past experiences of the data. Machine Learning has wide range of application areas like image recognition, text classification, automated translation, self-driven vehicles, virtual personal assistants, email spam filtration, medical diagnosis, weather forecasting etc. The main aim of this paper is to throw light on various machine learning algorithms.

Key Words: Machine Learning, Supervised Learning, Unsupervised Learning, Reinforcement, Ensemble Learning.

Paper-104

RECENT DEVELOPMENTS IN GRAPH THEORY AND ITS APPLICATION: A SURVEY

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ABSTRACT

Graph theory (GT) plays a vital role in almost every other field. GT is a branch of mathematics used in structural models. These structural models lead to development and changes in numerous fields. Structural Graph theory began in 1735 with the Koinsberg Bridge problem. From 1735 onwards structural graph theory has changed the way of thinking to find out the solution of a problem. Applications of graph theory have generated across the academic spectrum in the recent years. Common applications of graph theory- analyses of connectivity, network structure, path or transport efficiency, sub networks, network optimization or engineering – all have uses different fields . In this paper, we give the introduction to graph theory and review previous applications or works in related fields. Core aim of present paper is to run an outline of the uses of graph theory in the numerous areas.

Key Words : Graph Theory(GT), Network Structure, Connectivity

Paper-105

FREE CONVECTIVE FLOW THROUGH POROUS MEDIUM BETWEEN TWO PARALLEL VERTICAL POROUS WALLS

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ABSTRACT

Free convective viscous flow through porous medium between two parallel porous walls is investigated. The expression for the velocity and temperature distributions are derived, discussed numerically and shown through graphs by using perturbation technique. The expressions for the skin-friction amplitude and phase, rate of heat transfer amplitude and phase have been discussed with their respective dependence on Grashoff number, Prandtl number, the frequency of oscillation, permeability parameter, suction parameter and Eckert number.

Paper-106

STABILITY OF STRATIFIED VISCOELASTIC WALTERS' (MODEL B′) FLUID/PLASMA IN HYDROMAGNETICS IN THE PRESENCE OF QUANTUM PHYSICS

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ABSTRACT

Quantum effects on the Rayleigh-Taylor Instability in an inhomogeneous stratified incompressible, viscoelastic Walters' (model B') fluid/plasma in hydromagnetics are investigated. The linear growth rate is derived for the case where a plasma with exponential density, viscosity, viscoelasticity and quantum parameter distribution is confined between two rigid planes at $z = 0, z = d$. The solution of the linearized equations of the system together with the boundary conditions leads to derive the dispersion relation (the relation between the normalized growth rate and square normalized behaviour wave number) using normal mode technique to explain the roles that play the variables of the problem. The behaviour of growth rates with respect to the quantum effect and kinematic viscoelasticity are examined in the presence of kinematic viscosity. The results show that the vertical magnetic field bring about more stability for a certain wave number band on the growth rate of unstable configuration.

Paper-107

POSITIVE PARTIAL ORDERED Γ-SEMIRINGS

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ABSTRACT
Many of semirings originally studied, such as N and ideal (R) have a partial-order structure in addition to their algebraic structure and the most interesting theorems concerning them make use of the interplay between these two structures. Therefore, it is natural for us to study Γ- semirings over them on which a partial-order is defined. By using the conditions of centreless, simple, additive idempotent multiplicative Γ- idempotent, we find some of the results of positive partial-ordered Γ- semirings.
Key Words: Simple Γ −semiring, positive partial-ordered Γ − semiring, Centreless Γ − semiring.

Paper-108

NANOPARTICLE SHAPE EFFECTS ON THE HYBRID NANOFLUID FLOW ACROSS THE CONE-DISK CONFIGURATION

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ABSTRACT
The fluid flow within a conical gap of cone-disk apparatus has applications in medical devices, viscosimeters, conical diffusers, etc. In this study, we examined the impacts of different nanoparticle morphologies in a hybrid nanofluid flow within a conical gap of cone-disk apparatus.

The steady flow of hybrid nanofluid with ethylene glycol as base fluid and Fe_3O_4+TiO_2 as nanoparticles is considered. The disk is assumed to possess the riga disk properties in order to generate the exponentially decaying wall parallel Lorentz force. A variety of different Fe_3O_4+TiO_2 hybrid nanoparticle forms, such as spheres, bricks, blades, cylinders, and platelets are explored. The present study is limited to the assumption of constant total volume fraction of nanoparticles with in the fluid. Suitable similarity mappings are used to convert the leading partial differential equations (PDEs) into non-linear ordinary differential equations (ODEs). Depending on the boundary conditions, the system of equations in the form of ODEs is numerically simulated by the bvp5c MATLAB solver. Specifically, it is determined that increasing the volume percentage of both the nanoparticles effectively increases the heat transmission rate and velocity. It is also evident from the simulations that Hartmann number has positive impact for the axial velocity of the hybrid nanofluid, whereas reverse impact has been noticed for the radial velocity.
Keywords: Conical gap, hybrid nanofluid, riga disk, cone-disk apparatus, rotation

Paper-109

DESIGN AND IMPLEMENTATION OF A SECURITY FRAMEWORK FOR BRAIN-COMPUTER INTERFACE

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ABSTRACT

Brain-computer interface (BCI) is a collaboration between the user's neural activity and an external device. This advancement holds significant importance in a multitude of fields, spanning from healthcare and rehabilitation to gaming and neuro-engineering. There are some major problems with this emerging technology including malicious interference and especially in applications where BCIs are used for authentication or control of sensitive systems. To address these issues, this paper proposes a novel security strategy, i.e., an image encryption technique, for P300-based BCI devices. In particular, this approach integrates a P300-based BCI program with image encryption to enhance the integrity and confidentiality of transmitted information, thereby safeguarding the users and the integrated EEG hardware-software system. In this paper, we discuss the simulation of image encryption techniques in a P300-based BCI, illustrating the efficacy and efficiency of our proposed method. Experimental observations demonstrate that our approach offers a high level of security, providing a promising solution to the emerging security challenges confronted by P300-based BCI systems.
Keywords:- Brain-computer interface (BCI), Security, Image Encryption, P300-based BCI.

Paper-110

PLANE SH WAVE RESPONSE FROM SELF-REINFORCED ELASTIC LAYER INTERPOSED BETWEENTWO DIFFERENT MEDIA (MONOCLINIC ETC.)

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ABSTRACT

The reflection and transmission coefficient are obtained when a plane Sh-waves becomes incident at a uniform elastic layer interposed between two different self-reinforced elastic solid half – spaces. It is found that the reflection and transmission coefficient are strongly influenced by the reinforcement parameters of the half- spaces. Numerical computations are performed for a specific model to study the effect of reinforcement parameters and angle of the incident wave on the incident wave on these coefficients. Numerical study reveals that both coefficient are significantly influenced by the reinforcement parameters in the entire range of angle of incidence, except at normal and grazing incident where at the effect of reinforcement parameters is found minimum.

Paper-111

COMPOSITION OPERATORS WITH BICOMPLEX SCALARS AND THEIR ACTION ON WEIGHTED BICOMPLEX BERGMAN SPACES.

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ABSTRACT

In this paper, we study the bicomplex version of weighted Bergman spaces and the composition operators acting on them. We also investigate the Bergman kernel, duality properties and Berezin transform. This paper is essentially based on the work of Zhu (Operator Theory in Function Spaces of Math. Surveys and Monographs, vol. 138, 2nd edn. American Mathematical Society, Providence, 2007).

Paper-112

OPTIMIZING NON-LINEAR PROGRAMMING PROBLEMS: A REVIEW

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ABSTRACT

Nonlinear programming (NLP) has emerged as a prevailing tool for optimizing complex systems in various fields, such as engineering, physical sciences, life sciences and operations research to name a few. This review paper discussed number of methodologies used to solve nonlinear programming problems, encircling classical and derivative-free optimization methods. Paper also reviews the challenges and future directions in the field of nonlinear programming. This includes large-scale optimization problems scalability issues, robust optimization techniques in the presence of uncertainty, and its integration with emerging technologies like artificial intelligence and quantum computing.

Keywords: NLP, optimization methods, Artificial intelligence, Operation Research

Paper-113

COMPUTATIONAL PHYSICS: ROLE IN INTERDISCIPLINARY RESEARCH

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ABSTRACT

Computational Physics holds a pivotal position in interdisciplinary research spanning Mathematics, Astrophysics, and Computational Science, offering solutions to intricate problems. Employing numerical analysis, computational physics harnesses programs and algorithms written in scientific languages like FORTRAN, C/C++, to tackle advanced research challenges. Through computational techniques, we can visualize complex phenomena such as the wave function of particles in a confined space (e.g., particle in a box problem) or the wave function of a Harmonic Oscillator. Additionally, we can model the trajectories of satellites. These methodologies extend beyond visualization, serving simulation purposes for complex research issues in space exploration. Computational physics significantly contributes to advancing research in mathematical sciences and space exploration, whether theoretical or experimental in nature. This paper delves into the multifaceted applications of computational techniques across various research domains.

Key Words: 1. Computational 2.Technique 3.wave Function 4.Fortran 5. Trajectories

Paper-114

IMPACT OF MAGNETIC FIELD ON THE UPPER CONVECTED MAXWELL NANOFLUID DUCT FLOW IN A STRATIFIED ENVIRONMENT

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ABSTRACT

The understanding of the stratification environment due to the temperature and density differences in a flow field is very important for the analysis of several natural and industrial processes, which finds applications in variety of mechanisms such as climate control , solar heating(both passive and active), and the transportation facilitated by lakes and oceans. The Upper Convected Maxwell model, which incorporates both elastic and viscous characteristics, is influenced by the duration of relaxation and observation. The UCM model is significant in the design of effectual cooling systems, understanding the rate of heat transmission and flow characteristics of viscoelastic nanofluids, forecasting the behaviour of nanofluids employed in drug delivery systems, predicting the processing characteristics of polymers, and understanding the flow characteristics and stability of cosmetic products containing nanoparticles. In the present study, a strong normal magnetic field is applied to control the flow properties in a duct which is under the influence of thermal and solutal stratifications. The governing equations are converted into dimensionless form with suitable transformations. The numerical simulation is performed using MATLAB R2023a, and the results are portrayed through graphs and tables. It is found that an interaction between magnetic field and stratification (thermal/solutal) offers a valuable insight in the management of the duct flow field mechanism.

Keywords: Duct flow, magnetic field, Upper Convected Maxwell model(UCM) , thermal and solutal stratification.

Paper-115

FUNDAMENTAL SOLUTION OF STEADY OSCILLATIONS IN MODIFIED COUPLE STRESS THERMOELASTIC WITH DUAL PHASE LAG MODEL

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ABSTRACT

This problem deals with the study of propagation of plane waves in modified couple stress thermoelastic medium in the context of dual phase lag model. It is found that for two-dimensional model, there exists two longitudinal waves, namely, longitudinal wave, thermal wave, and a set of coupled transverse waves. The fundamental solution for the system of differential equations for steady oscillations in terms of elementary functions has been constructed. Some properties of fundamental solution are also established. The phase velocity, attenuation coefficient, specific loss and penetration depth are computed numerically and presented graphically to see the effect of dual phase lag model in the absence and presence of couple stress parameter.

Keywords: Thermoelasticity, Modified couple stress theory, Fundamental solution, Steady oscillations, Dual phase lag model.

Paper-116

A STUDY OF VALUATION SEMIRING

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ABSTRACT

This paper deals with the study of valuation and discrete semirings. Here some properties of valuation maps on these semirings are investigated and few results regarding integrally closed valuation semirings are examined. Moreover, the condition which makes a semiring to discrete valuation semiring is discussed.

Paper-117

HALF-SPACE PROBLEM IN THERMOELASTIC DIFFUSION UNDER HYPERBOLIC TWO TEMPERATURE THEORY

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ABSTRACT

The theory of elasticity involves the study of displacement, strain and stresses of deformable bodies occurring due to application of external forces. In the theory of linear elasticity the effect of temperature on the deformation of body was not taken. But in general, the effect of temperature cannot be ignored. Most solids exhibit a volumetric change with temperature variations occurs. Therefore, for problems involving high-temperature variations, the temperature change affects the deformation. Therefore, the total deformation is due to the combination of both mechanical and thermal fields of solid. Thermoelasticity theory is a combination of elasticity and heat conduction theories. It is related to the impact of heat on deformation of an elastic medium and inverse impact of the deformation on the thermal conduction of considered medium. The theory of thermoelasticity has various applications in the field of machine structure, and other areas of engineering. Thermoelasticity theories can be divided into Uncoupled, Coupled and Generalized thermoelasticity. In Uncoupled theory of thermoelasticity effect of temperature on deformation is taken along with the theory of elasticity but, converse effect was not considered. Biot proposed the theory of coupled thermoelasticity to eliminate the paradox that the elastic change does not affect temperature. It involves the coupling of temperature and strain fields. The heat conduction equation in UCT and CT is parabolic type, it predicts infinite velocity for the propagation of thermal signals. It means that the effect of thermal disturbance is felt at a location far distance from the source instantaneously. But, it is the physically impossible result. To overcome this paradox, generalized theories of thermoelasticity have been introduced. In these theories hyperbolic type of heat conduction equation involves which predict finite speed for propagation of thermal signals.

Spontaneous movement of the particles in the medium, from region of higher concentration to lower ones is defined as Diffusion. Diffusion also happens when there is a concentration gradient. Mass transfer occurs due to the application of different driving forces such as pressure gradient, concentration gradient as well as external forces. Furthermore, Fractional calculus enables us to study the hereditary properties of the system. When heat transportation in a deformable body is based on phonon-electron interactions, hyperbolic two temperature theory of generalized thermoelasticity plays crucial role. This theory states that heat transport is governed by two distinct temperatures, conductive temperature and thermodynamic temperature. The present problem

examines a two-dimensional elastic half-space that is thermo-diffusive The uniqueness of the current study is increased by using a hyperbolic two-temperature thermoelastic diffusion model based. The problem is solved using Laplace–Fourier transformed domain with initial and boundary restrictions. To obtain the results in space-time domain, numerical inversion technique is applied. The impact of various parameters on dimensionless field variables involved in the study is analyzed graphically.

Paper-118

STATIONARY CONVECTION IN A LAYER OF COUPLE – STRESS NANOFLUID : FREE-FREE, RIGID-RIGID AND RIGID-FREE BOUNDARIES

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ABSTRACT

This paper is concerned with the stationary convection in a horizontal layer of Couple-Stress nanofluid. Brownian diffusion and thermophoresis effects are incorporated into the couple-stress nanofluid model. The perturbation method and normal mode analysis are employed to solve the eigen value problem. The dispersion relation has been derived and solved analytically. Effects of the couple stress parameter, Lewis number, modified diffusivity ratio, concentration Rayleigh number on stationary convection are examined analytically and graphically.

Keywords: Couple-stress nanofluid, Brownian motion and thermophoresis, Galerkin type weighted residual method.

Paper-119

AN EXPERIMENTAL EVALUATION OF QUANTUM MACHINE LEARNING ALGORITHM FOR SYMBOL DETECTION WITH NOISY OBSERVATION

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ABSTRACT

Development in quantum machine learning (QML) and quantum communication (QC) is gaining traction as fields of complexity. Here, we demonstrate a modified version of the quantum K-nearest neighbour (QKNN) algorithm for communication system symbol detection. In this article, we propose a method to get rid of quantum search operations for small search spaces like 32-QAM symbols by including a quantum swap-test circuit that quickly figures out the distance between unknown symbols and known training symbols. The numerical results of simulating the proposed quantum circuit on an IBM quantum computer show the effectiveness of the proposed framework. The improvement of quantum resources in terms of gate complexity is examined and action accuracy as a performance parameter is demonstrated.

Key Words: Quantum Communication, Quantum Machine Learning, Quantum Simulation, Quantum K-nearest neighbour.

Paper-120

ENCRYPTION OF MENEZES-VANSTONE ELLIPTIC CURVE CRYPTOGRAPHY

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ABSTRACT

Security plays a critical position in preserving information privacy and secrecy. Many encryption strategies are available to protect data during transmission or storage. These encryption methods vary in terms of strength, speed, and resource consumption. Elliptic curve cryptography is one of the most effective technique that is used in portable devices. This study aims to present the most popular and interesting algorithms currently in use. We discuss about the Menezes-Vanstone elliptic curve cryptography, which help us to develop a safe and secure environment during online communications.

Keywords: Cryptography, data security, Public Key, Resource Consumption, Secret Key.

Paper-121

A SURVEY ON GAUSS–SEIDEL ITERATION METHOD FOR SOLVING ABSOLUTE VALUE EQUATIONS

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ABSTRACT

Different trending fields such as operations research, management science, and engineering fields involves many problems that require the solution of absolute value equations. An efficient and useful technique for resolving the absolute value equations for this purpose is the iterative Gauss-Seidel method. The solution efficiency of the iterative Gauss-Seidel method for solving the absolute value problems has been performed in recent research.

In our paper, we review modifications in the iterative Gauss-Seidel method for solving these equations with a certain large scale and its verification of the feasibility, robustness and effectiveness of different methods to increase its efficiency.

Keyword: Gauss-Seidel method, Absolute value equations

Paper-122

DERIVATIONS ON SEMIRINGS OF UPPER TRIANGULAR MATRICES

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ABSTRACT

In this paper, we delve into the intricate relationship between Jordan derivations and derivations in the context of Semirings. We explore the conditions under which a Jordan derivation becomes a derivation and establish that every Jordan derivation from the Semirings of upper triangular matrices to its bimodule can be decomposed into a derivation and an antiderivation.

Paper-123

SHORT-TERM TRAFFIC FLOW PREDICTION USING ARTIFICIAL INTELLIGENCE (AI)

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ABSTRACT

Short-term traffic flow prediction is necessary to manage and seize the dynamic traffic. As a crucial component of the Intelligent Transportation System (ITS), it serves as core for researchers and traffic management authorities. Regarding the prediction horizon, short-term prediction is frequently used with an emphasis on time intervals of 15 to 30 minutes, as it is more effective in capturing the flow pattern. The prediction task is difficult due to intricate spatial relationships and changing traffic patterns throughout the time. In order to handle the forecasting model's complexity and manual hyper parameters tuning, the fundamental artificial intelligence (AI) based models have been combined with a variety of optimization strategies. This paper proposes a novel approach that utilises artificial intelligence techniques for short term traffic flow prediction. Specifically, the model employs a Long Short- Term Memory (LSTM) network to capture the temporal dependencies in traffic flow data along with the optimization techniques. The proposed approach can be valuable for traffic management systems to alleviate the traffic congestion.

Keywords: Short-term traffic flow prediction, Artificial Intelligence (AI), Intelligent Transportation System (ITS), Long Short- Term Memory (LSTM).

Paper-124

REVIEW OF THE MATHEMATICAL MODELLING OF COVID-19 DISEASE

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ABSTRACT

The COVID-19 pandemic has imposed a massive global health burden in recent times. COVID-19 is the illness caused by the SARS-CoV-2 virus . Typically, the transmission primarily occurs through the close contact between the persons. To understand the Covid-19 outbreak, the study of

the trustworthy predictive mathematical models are essential. The study focuses on widely used methods for Covid-19 epidemic mathematical modelling. Popular mathematical models are compared in this work according to their assumptions, limitations and practical validity. Overall findings suggested that there was a great deal of variation in the kinds of models, how long they forecasted for, and the variable they predicted, where the most frequent use of SEIR modes is observed. This systematic review will enable the researchers to identify and validate the parameters and decide the utility of assumptions while developing the models for related diseases.
Keywords: COVID-19, SARS-CoV-2 virus, Mathematical models, Systematic review.

Paper-125

DISTINGUISHING LABELLING FOR THE DIRECT PRODUCT ACTION

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ABSTRACT
In this paper, the coordinate wise action of a direct product $S_2 \times S_n$ on the set $[2] \times [n]$, where $[2] = \{1,2\}$ and $[n] = \{1,2, \dots, n\}$ is characterized. The distinguishing number and a corresponding distinguishing labelling are computed, for every n. An optimal algorithm to obtain the above said labelling is also discussed.
Key words: Distinguishing number, distinguishing group actions, distinguishing labelling of sets.

Paper-126

GAMIFICATION IN MATHEMATICAL SCIENCES: A META-ANALYSIS OF EFFECTIVENESS AND ADVANCEMENTS

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Abstract
In recent years, the integration of gamification techniques into educational practices has gained significant attention, particularly in the domain of mathematical learning. This comprehensive meta-analysis explores the intricate relationship between gamification and mathematical

education, aiming to provide a thorough examination of its effectiveness and advancements. Drawing upon a systematic review of literature encompassing diverse educational contexts and settings, this meta-analysis scrutinizes the collective findings of numerous studies investigating the impact of gamified interventions on mathematical learning. Through meticulous data synthesis and statistical analysis, the study quantifies the effect sizes associated with gamification techniques, shedding light on the magnitude of their influence on various aspects of mathematical education, including conceptual understanding, problem-solving skills, and academic achievement. Furthermore, this meta-analysis examines the underlying mechanisms and potential moderators that mediate the relationship between gamification and mathematical learning outcomes. By exploring factors such as student characteristics, instructional design elements, and implementation strategies, the study clarifies the subtle dynamics shaping the effectiveness of gamified approaches in mathematics education.

Moreover, this research goes beyond assessing the immediate impact of gamification and examines its long-term implications for fostering sustained engagement and intrinsic motivation among learners. By synthesizing evidence from longitudinal studies and longitudinal follow-ups, the meta-analysis offers insights into the enduring effects of gamified interventions on students' attitudes towards mathematics and their propensity for continued learning. In addition to evaluating the effectiveness of existing gamification strategies, this meta-analysis identifies emerging trends and advancements in the field of educational gamification that hold promise for enhancing mathematical education. From immersive virtual environments and adaptive learning platforms to personalized feedback mechanisms and collaborative gaming experiences, the study highlights innovative approaches that leverage technology to transform mathematical learning experiences. By synthesizing empirical evidence from a multitude of studies, this meta-analysis not only contributes to a deeper understanding of the impact of gamification on mathematical education but also informs educators, policymakers, and researchers about effective strategies for integrating gamified elements into instructional practices. Ultimately, this research underscores the potential of gamification as a transformative tool for promoting meaningful and engaging mathematical learning experiences in diverse educational contexts.

Keywords: Gamification, Mathematical education/sciences, Meta-analysis, Learning outcomes, Engagement & Motivation.

Paper-127

ROLE, NEED AND BENEFITS OF MATHEMATICS IN THE DEVELOPMENT OF SOCIETY

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ABSTRACT

Mathematics is a field of science that studies numbers and how they are used. It includes calculations, computations and problem solving, among other things. It is a subject that is accurate, precise, methodical and logical. Mathematics has been defined in a variety of ways throughout history; it is an indispensible component of science and is utilized in virtually every discipline, including natural science, engineering, art and economics. Mathematics is a vital instrument in our lives and in every scientific field that promotes personal growth and development on a broad scale. To avoid chaos and confusion, mathematics makes life smoother and more organized. Problem solving, creativity, critical thinking and reasoning capacity are some of the traits and talents fostered by mathematics. Everyone requires mathematics in their daily lives, whether they are a cook or a farmer, a carpenter or a mechanic, or a doctor, an engineer or a scientist or a magician. Therefore, it would be impossible to summarize mathematics applications in each field. It goes through the impact of social demands and how to play a part in applying mathematics.

Keywords: Analysis, Problem Solving, Critical Thinking Abilities

Paper-128

A NOVEL DISTANCE MEASURE FOR Q-RUNG ORTHOPAIR FUZZY SET WITH TOPSIS APPROACH

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ABSTRACT

The Pythagorean Fuzzy Set (PFS) and the Intuitionistic Fuzzy Set (IFS) can both encounter issues that the q-ROFS (q-Rung Orthopair Fuzzy Set) can resolve. This study proposes a Distance Measure based upon the q-ROFS idea which satisfies all of the axioms. Furthermore, a multi-criteria decision-making problem with the proposed distance measure and TOPSIS (Technique for

Order of Preference by Similarity to Ideal Solution) has been presented. Lastly, a numerical example and illustration for the suggested distance measure have been supplied.
Keywords- q-ROFS, TOPSIS, Distance Measure, MCDM.

Paper-129

"OPTIMAL CROP PLAN THROUGH THE LINEAR PROGRAMMING TECHNIQUE" IN COMMUNITY DEVELOPMENT BLOCK RAMPUR OF DISTRICT SHIMLA

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ABSTRACT

Agriculture is widely considered as backbone and one of the critical sector of Indian economy. This sector of economy has undergone drastic changes over the years. One of the most discernible change that has received academic and professional attention has been its declining share in gross domestic product. The share of agriculture which was more than 50 per cent before independence that has come down to 15 per cent in 2022-23. As far as agricultural production is concerned there has been persistent fluctuation in farm output and market return. Owing to certain policy, institutional, technical and climatic issues the crop pattern and practices has changed over the year. Keeping in view the issues and challenges associated with crop yield, pattern and practices an attempt has been made to evolve an optimal cropping plan so as to ensure economic upliftment of farmers and ensure increased farm output and farm return. For this Linear Programming has been applied and data has been collected through the random sampling. An attempt has been made to include atleast 15 to 20 farmers of Community Development block Rampur District.
Keywords: Economy, Gross Domestic Product, Crop pattern, farm output/return.

Paper-130

STABILITY ANALYSIS OF DOUBLE-DIFFUSIVE CONVECTION PROBLEMS COUPLED WITH CROSS-DIFFUSIONS

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ABSTRACT

The stability of double diffusive convection problems coupled with cross – diffusions in the domain of linear stability theory in a more comprehensive manner was analyzed mathematically.

Linear stability behaviour has been examined through rigorous mathematical analysis for all combinations of rigid and dynamically free boundaries. In the present analysis the methods adopted by Chandrasekhar et al. and Gupta et al. to obtain some qualitative results concerning the stability or otherwise.

This is primarily motivated by the work of Hurle and Jackman, McDugall and Gupta et al. . The problem of onset of convective instability in a horizontal layer of two component fluid subjected to vertical temperature and concentration gradients is examined taking into account the cross – diffusions and the problem is analysed mathematically.

Paper-131

MATHEMATICAL CHEMISTRY

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ABSTRACT

Mathematical Chemistry is the area of research engaged in novel applications of mathematics to chemistry; it concerns itself principally with the mathematical modeling of chemical phenomena. Mathematical chemistry has also sometimes been called computer chemistry. Major areas of research in mathematical chemistry include chemical graph theory, which deals with topology such as the mathematical study of isomerism and the development of topological descriptors or indices which find application in quantitative structure-property relationships; and chemical aspects of group theory, which finds applications in stereochemistry and quantum chemistry. Another important area is molecular knot theory

and circuit topology that describe the topology of folded linear molecules such as proteins and nucleic acids. “The Principles of Mathematical Chemistry: The Energetics of Chemical Phenomena" gives a detailed information about the topic energetics and its relation with Mathematics. Some of the more contemporary periodical publications specializing in the field are MATCH Communications in Mathematical and in Computer Chemistry. The basic models for mathematical chemistry are molecular graph and topological index. In 2005 the International Academy of Mathematical Chemistry (IAMC) was founded in Dubrovnik (Croatia) by Milan Randić. The Academy has 82 members (2009) from all over the world, including six scientists awarded with a Nobel Prize.

Key Words: Isomerism, Quantitative, Stereochemistry, Quantum, Energetics.

Paper-132

NANOHEXFERRITES: THE MATHEMATICS BEHIND THE MINUSCULE

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ABSTRACT

The title refers to the examination of the intricate connection between nanomaterials and mathematical principles. It implies an investigation into how mathematical concepts and methods play a crucial role in comprehending, modeling, and controlling structures and properties at the nanoscale. The title underscores the vital importance of mathematics or mathematical equations in advancing nanotechnology, where accurate calculations and mathematical frameworks are indispensable for crafting and enhancing nanomaterials with tailored properties and functions. Co_2Z type nanohexaferrites of nominal composition $Ba_{1.5}Sr_{1.5}Co_{2-z}Y_zMn_xNi_yFe_{24-x-y}O_{41}$ were synthesized by auto combustion sol-gel technique. XRD studies revealed that the particles ranged from 43 - 55nm and are nearly pure Z-type single phased with space group $P6_3/mmc$. A negligible increase and noticeable decreasing trend is observed in lattice parameter ‘a’ and ‘c’. SEM images confirmed the formation of hexagonal nano particles with some observed agglomerations and the reason behind the agglomeration is the magnetic behaviour and weak Vander Walls forces. Simmilarly, electrical conductivity of the synthesized samples was also carried out by Keithley 2611system source meter using Au dot as upper electrode. In order to calculate DC resistivity, V-I characteristics were observed as a function of temperature in the temperature range from 333K to 473K. The DC electrical resistivity of Y-Mn-Ni substituted samples at room temperature, decreases from 7.09×10^7 (Ω-cm) to 1.63×10^5 (Ω-cm) and the drift mobility increases from 3.76×

10^{-12} (cm^2/V-s) to 1.98 × 10^{-9}(cm^2/V-s) with the increase of Y^{3+} ion concentration in Ba-Sr hexaferrite samples. Similarly the activation energy was observed with considerable reduced value i.e .033eV. VSM demonstrates that the hysteresis loops in the range ±20kOe applied field at room temperature are extremely narrow with M_s(44.04 – 35.59 emu/g) and coercivity (H_c) (42.3 – 248.96Oe) ascribing distinctive qualities of nanohexaferrite with high coercivity. All these mathematical tools have contributed to the discovery and understanding of the characteristics exhibited by synthesized nanomaterials.

Keywords: Y-Mn-Ni substitutions, Spectroscopy, Sol-gel auto combustion, Microstructure, Morphology, Electrical properties, Dielectric properties. Magnetic measurement.

Paper-133

DATA MANAGEMENT AND TRANSFORMATION OF RESEARCH THROUGH SPSS

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ABSTRACT

Research is basically a systematic enquiry or an objective process of gathering data for the purpose of making decisions. Research is a fact finding process which is undertaken through a systematic procedure which includes collection, compilation presentation and interpretation of data. Statistics is that branch of mathematics that converts data into some useful information. This transformation requires complex calculations which can easily be done using computers. Attempting these computations manually is sometimes a herculean task for researchers. Therefore, SPSS was created to help researchers in handling large volume of data that they collect during their research study. SPSS is compatible in accepting data of different file format and use them to generate tabulated reports, charts, and graphs including descriptive and inferential statistics. Research approaches are divided into two categories one is deductive and the inductive research and second one is qualitative and quantitative research. Inferences that are drawn from a general principle to a particular conclusion constitute deductive research and inferences which are drawn from the evidence in the form of conclusions which explain evidences of facts constitute inductive research. The quantitative approach includes generalisation based on the results of the study conducted and quantitative research aims as better understanding of the problem. This research paper aims to study that how SPSS software useful for the researchers to do the quantitative research in a less time.

Keywords: Research, SPSS Software, Quantitative Research, Transformation.

Paper-134

UNLOCKING COMPUTATIONAL EFFICIENCY: EXPLORING VEDIC MATHEMATICS AND ITS INTEGRATION INTO COMPUTER SCIENCE

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ABSTRACT

Vedic Mathematics, an ancient system of Indian mathematical techniques derived from the Vedas, offers a unique approach to mathematical computation. This paper explores the principles of Vedic Mathematics and its applications in the field of computer science. Vedic Mathematics encompasses a wide array of techniques ranging from simple arithmetic to complex algebraic manipulations. In the computer science, Vedic Mathematics has found applications in various domains including algorithm design, cryptography, error correction codes, and artificial intelligence. Its algorithms offer efficient solutions to fundamental mathematical operations such as multiplication, division, square roots, and exponentiation, which form the backbone of numerous computational tasks. This paper reviews the principles of Vedic Mathematics, discusses its relevance to computer science, and presents case studies illustrating its practical applications in algorithm optimization, cryptography, and artificial intelligence. Through a comprehensive analysis of its techniques and their integration into modern computational paradigms, this paper highlights the significance of Vedic Mathematics as a valuable resource for advancing computational efficiency and innovation in computer science.

Keywords: Vedic Mathematics, computational efficiency, algorithm design, cryptography, artificial intelligence

Paper-135

ADVANCEMENTS IN CODING THEORY: A COMPREHENSIVE REVIEW

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ABSTRACT

Coding theory serves as a fundamental pillar in the realm of information theory and digital communication systems. We presents a comprehensive review of recent advancements and key concepts in coding theory, focusing on its significance in modern information transmission, error detection and correction theory. This paper begins with an overview of the historical development

of coding theory, highlighting its evolution from simple error detection codes to sophisticated error correction algorithms. It then delves into the fundamental principles of coding theory, elucidating concepts such as block codes, convolution codes and Reed-Solomon codes among others. Subsequently, the paper discusses the practical applications of coding theory in various domains, including telecommunications and storage systems and digital multimedia transmission. It examines the use of coding theory in ensuring reliable and efficient communication in the presence of noise, interference and channel impairments.

Keywords: Error Correction Codes, Information Theory, Convolutional Codes, Reed-Solomon Codes, Channel Coding, Error Detection, Decoding Algorithms.

Paper-136

THE EPISTEMOLOGY OF ARTIFICIAL INTELLIGENCE: EXAMINING THE NATURE OF KNOWLEDGE IN AI SYSTEM

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ABSTRACT

Artificial Intelligence (AI) deals with the intelligence of machines or software, rather than the intelligence of rational beings. AI has made a division in how we correspond with technology and analyze data, and it has caused profound questions about the nature of knowledge within AI systems. In this study, the epistemological foundations of AI are examined by looking at how intelligent systems acquire, represent, and apply knowledge. Through insights from philosophy of mind, cognitive science, and computer science, this research explores the cognitive processes that drive AI decision-making and problem-solving. By investigating the mechanisms through which AI algorithms learn from data, adapt to novel situations, and generate insights, we aim to elucidate the epistemic status of knowledge produced by AI systems. Additionally, this study examines the impact of AI-generated knowledge on human comprehension, decision-making, and ethical considerations. Our objective is to promote a better understanding of the epistemological challenges presented by artificial intelligence by critically analyzing the limitations and biases that are inherent in AI knowledge acquisition and dissemination. This study, using a multidisciplinary approach that combines philosophical inquiry with empirical research, is an important contributor to ongoing conversations about the nature of knowledge, intelligence, and cognition in the age of AI. By dissecting the epistemological intricacies of AI systems, we present insights that may help to develop more transparent, responsible, and ethically grounded AI technologies in the future.

Keywords: artificial intelligence, epistemology, knowledge, cognitive science, philosophy of mind

Paper-137

GEOMETRY OF SCREEN SEMI-INVARIANT LIGHTLIKE SUBMANIFOLDS OF A METALLIC SEMI-RIEMANNIAN MANIFOLD ENDOWED WITH A QUARTER SYMMETRIC NON-METRIC CONNECTION

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ABSTRACT

The present study examines the structure of screen semi-invariant (SSI)-lightlike submanifolds of a metallic semi-Riemannian manifold equipped with a quarter symmetric non-metric connection. Results on integrability and parallelism of the distributions have been obtained. The geometry of the totally geodesic foliations in SSI-lightlike submanifolds has also been investigated.

Paper-138

SEMI-BAER N −GROUPS AND NEARRINGS

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ABSTRACT

In this paper, the concepts of multiplicative order of an element and multiplicatively finite elements in nearrings has been introduced to define semi-Baer and semi-quasi Baer N-groups which are the generalizations of Baer and quasi-Baer nearrings analogous to rings]. Using these concepts, semi-Baerness of N-groups is characterized over reduced nearring. It is proved that the polynomial (including power series, Laurent polynomial and Laurent power series) extensions of N-groups preserves semi-Baerness. Further, it is shown that for a nearring N and monoid G, if the monoid nearring NG is semi-Baer then so is N.

Paper-139
Applications of Computer Simulations in Biosciences

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Abstract

Computer simulation is a crucial research tool in today's scientific landscape. Computers enable us to conduct computations that replicate the behavior of intricate biological systems in ways otherwise unattainable. These simulations resemble computer games, where a virtual world adheres to specific physical rules. As we engage with the game, we comprehend the rules governing this virtual realm and its environment, as well as our impact on it as players. This study aims to elucidate how computer simulations can be employed in structural biology to investigate the structure and function of molecules. Additionally, it outlines the benefits of leveraging biology and computer simulations to advance society, particularly in the realm of medical science.
Key words :Computer simulations, ,Biological system, Medical science

Paper-140
TEMPERATURE DISTRIBUTION IN OUTER LAYERS OF HUMAN BODY WITH UNIFORMLY PERFUSED TUMOR: FINITE ELEMENT METHOD BASED STUDY

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ABSTRACT

A mathematical study of temperature distribution in dermal part of human body with uniformly perfused tumor has been carried out. The region under study is divided into five layers in which epidermis and subcutaneous tissues parts contain one layer each and dermis region is divided into three layers where tumor exists. It is assumed that outer layer of skin is exposed to the atmosphere and has heat loosed and gain accordingly. The study incorporates effect of metabolic heat generation and blood mass flow rate. The normal and benign tissues are assumed to have normal rates of blood mass flow and self controlled metabolic heat generation and the malignant portion incorporates increased rates of blood mass flow and uncontrolled metabolic heat generation.

Keyword: Blood Mass Flow Rate, Metabolic Heat Generation, Finite Element Method, Normal and Benign Tissues.

Paper-141
APPLICATIONS OF DERIVATIVES AND MARGINAL CONCEPT IN ECONOMIC ANALYSIS

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Abstract

Derivatives and marginal analysis play pivotal roles in addressing economic problems across various domains. This research paper explores their applications in optimizing resource allocation, decision making processes, and risk management strategies. Marginal analysis, rooted in the concept of incremental changes, provides a framework for evaluating the additional benefits and cost associated with small changes in economic variables. By comparing marginal benefits to marginal costs, individuals and firms can make informed decisions to maximize utility or profit. This approach finds application in production optimization, pricing strategies, and resource allocation in both micro and macroeconomic contexts. Derivatives offer powerful tools for managing risk and uncertainty in economic activities. Whether in the form of options, futures, or swaps, derivatives enable individuals and organizations to hedge against adverse price movements, interest rate fluctuations, and currency risks. Through derivatives, market participants can transfer risk, enhance liquidity, and improve efficiency in financial markets. In overall, the integration of marginal analysis and derivatives provides valuable insights and solutions to the complex economic problems faced by individuals, firms, and policy makers. Understanding their applications and limitations is crucial for achieving allocation efficiency, managing risks, and fostering economic growth in an increasingly interconnected global economy.

Keywords: Derivatives, Marginal Analysis, Incremental Changes, Allocation Efficiency, Interconnected