NATIONAL CONFERENCE

ON

ANCIENT MATHEMATICS & ITS EMERGING AREAS

AMEA-2K24

SOUVENIR

Prof. R. K. Dwivedi : Conference General Chair
Dr. Vipin Kumar : Conference Convener
Dr. Ajit Kumar : Conference Co-Convener

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(24 April, 2024)

ORGANIZED BY

DEPARTMENT OF MATHEMATICS
FACULTY OF ENGINEERING
TEERTHANKER MAHAVEER UNIVERSITY, MORADABAD

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National Conference on Ancient Mathematics & its Emerging Areas

(AMEA-2K24)

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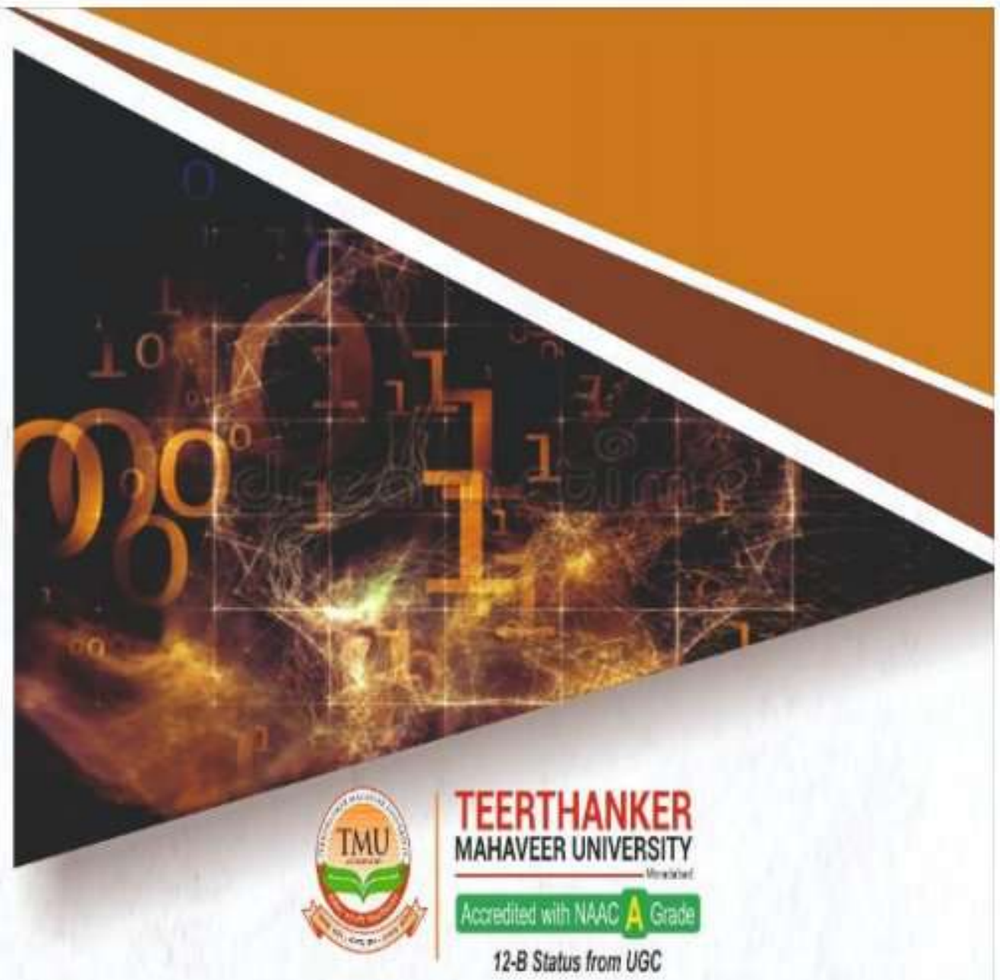

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DEPARTMENT OF MATHEMATICS

FACULTY OF ENGINEERING

TEERTHANKER MAHAVEER UNIVERSITY, MORADABAD

Organizes

NATIONAL CONFERENCE

on

Ancient Mathematics & its Emerging Areas

(AMEA-2024)

24 April, 2024 | 10:30 AM onwards

Venue : LT-6, FoE, TMU

Organizing Committee Members: Dr. Narotam Chauhan | Mr. V. S. Rawat | Mr. Ashok Kumar | Dr. Alok Gahlot

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Prof. R. K. Dwivedi

Conference General Chair & Principal

Faculty of Engineering

Teerthanker Mahaveer University, Moradabad

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Convenor

Dr. Vipin Kumar

Associate Professor, Department of Mathematics

Teerthanker Mahaveer University, Moradabad

Co-Convenor

Dr. Ajit Kumar

Associate Professor & HoD, Department of Mathematics

Teerthanker Mahaveer University, Moradabad

Organizing Secretary

Dr. Abhinav Saxena

Associate Professor, Department of Mathematics

Teerthanker Mahaveer University, Moradabad

Dr. Kamesh Kumar

Assistant Professor, Department of Mathematics

Teerthanker Mahaveer University, Moradabad

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- Dr. Narottam S Chauhan
- Dr Alok Kumar Gahlot
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- Dr. M K Chini
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Chief Guest & Keynote Speaker

Prof. Rashmi Bhardwaj,
Guru Govind Singh Indraprastha University (GGSIPU), New Delhi

Keynote Speaker and Session Chair

Dr. Nagendra Kumar,
Associate Professor, MMH College, Ghaziabad

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About The University

The Teerthanker Mahaveer University has been established by an 'Act' (No. 30) of 2008 of the Government of Uttar Pradesh and is approved by the University Grants Commission (UGC) vide letter No. F. 9-31/2008(CPP-1) dated October, 2008. The University is located on National Highway-24, Bareilly 144 Km from New Delhi. The University stands committed to the ideals of Lord Mahaveer- Right Philosophy, Right Knowledge, and Right Conduct - in all the spheres of activity and aspire to be recognized as the ultimate destination for world class education. The multi-disciplinary University offers career-oriented courses at all levels, i.e., UG, PG and Doctoral degrees across diverse streams, namely, Medical, Dental, Pharmacy, Nursing, Paramedical Sciences, Physiotherapy, Hospital Administration, Education, Physical Education, Engineering, Architecture, Polytechnic, Management, Law, Journalism, Fine Arts, Jain Studies, and Agriculture Science to meet rising aspirations of the youth.

The University provides a unique environment for students to grow under the guidance of experienced academicians. The highly committed team facilitates all round development of students to help them acquire the ability of lifelong learning and to make them competent professionals as well as good human being.

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About The College

Established in 2008, the Faculty of Engineering has emerged as a hub for academic excellence in engineering & science. The college contributes to quality education in all major disciplines of engineering & science and meet the needs of industry for trained technical manpower with practical experience and sound theoretical knowledge. The college has nine operational academic departments with more than a hundred full time faculty members. The college offers programs at bachelor, post-graduate and doctoral level, covering major branches of engineering science and technology. Experts from various areas are invited for interaction with the students. The college has entered into partnerships with leading universities and industries in India and abroad.

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About The Department

The Department of Mathematics has well qualified, dedicated and sincere faculty members to cater the need of students. The faculties of the Department of mathematics are competent who work tirelessly to help students to learn the basics along with advanced areas in the domain of mathematics for a future work. Department is honestly trying hard to provide strong mathematical foundation, analytical and computational skills. The challenging yet loving part of this process is gradual developments in abstract understanding and mathematical thinking of students.

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About The Conference

The "Ancient Mathematics & its Emerging Areas (AMEA-2K24)" is a wide forum for Mathematicians and Scientists who work in the expanding interdisciplinary areas of analysis and applied analysis, and its applications. This academic event is to provide a forum to presenting and sharing new ideas, techniques and alternative technologies in the field of Mathematics and Engineering. The conferences will feature keynote and invited talks by renowned academicians, researchers, scientist of National repute. The conference will provide an opportunity to present theoretical, experimental and visionary research papers.

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Objective of Conference

The main objective of Ancient Mathematics and its Emerging Areas (AMEA-2K24) is to provide forum for the researches, eminent academicians, research scholar and students to exchange ideas, to communicate and discuss research findings and new advances in Mathematical Sciences, Engineering and Technology. The conference would also enable participants to explore possible avenues to foster academic. The conference will give opportunity to both academicians as well as research scientists to communicate and discuss problems and their applications for industry sector. At the end of this conference, the participants will be enriched and motivated. It will help them to improve their research skills in the area of Mathematics, Engineering and Technology.

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Conference Tracks

- Algebra
- Algebraic Geometry
- Mathematical Analysis
- Mathematical Physics
- Graph Theory
- Quantum Theory
- Control Theory
- Mathematical Chemistry
- Cryptography
- Fourier and Wavelet Transforms
- Dynamic System
- Mathematical Biology
- Computational Mathematics
- Operation Research
- Numerical Analysis
- Optimization Technique
- Environmental Modelling
- Mathematical Computational Techniques
- Finite Element Mathematics
- Differential Equations
- Nano Science
- Mathematical Modelling and Simulation
- Genetic Sequencing
- Wavelets Theory

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Preface

We take this opportunity to welcome you all to the conference proceeding of the National Conference on Ancient Mathematics & its Emerging Areas (AMEA-2K24).

The objective is to bring eminent the academicians, scientists, researchers, industrialists, technocrats, government representatives, social visionaries and experts from all strata of society, under one roof, to explore the new horizons, of innovative technology to identify opportunities and defining the path forward. This new path should eliminate isolation, discourage redundant efforts and promote scientific progress aimed to accelerate India's overall growth to prominence on the international front and contribute effectively to realize and achieve the India mission of being a Development Nation. The conference will feature paper presentation sessions, invited talks, keynote addresses, and panel discussions and has attracted researchers and practitioners from academia, industry and government agencies, in order to exchange ideas and share their valuable experiences.

We are grateful to a number of people without which we would not have been able to successfully organize this mega event, in such a short period of record time. On behalf of the Conference Convener, I thank too many esteemed authors for having shown confidence in us and considered AMEA-2K24 a platform to share their work. We wish to express our gratitude to our focused and dedicated team of Co-conveners, Organizing Secretary, members of the Advisory Committee, Organizing Committee, Technical Committee and Local Organizing Committee and finally our students for being a great source of strength to us in making this conference successful.

We consider ourselves fortunate to get such a dedicated and ever supporting team.

We are personally thankful to our Conference General Chair & Principal, Prof. (Dr.) R. K. Dwivedi, who is always a constant source of technical guidance, as and when we needed.

Finally, we are thankful to one and all, who have contributed directly or indirectly in making this seminar successful.

Last but not the least, we take this opportunity to give the credit of successfully bringing out this conference proceeding to our team, one and all, and personally own the responsibility of all the errors, deficiency and shortcomings.

In the last, we are thankful to Almighty God for giving us strength in successful organization of this conference.

Dr. Vipin Kumar
Conference Convener
AMEA-2K24

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Message

I feel extremely happy and delighted to know that the Department of Mathematics, Faculty of Engineering is organizing a National Conference on Ancient Mathematics & its Emerging Areas on 24 April 2024 (AMEA-2K24).

It is a leap forward to put Faculty of Engineering & Computing Sciences is on the National map where the scientists, engineers and researchers from all over the country will converge and exchange their ideas for the growth of knowledge. Faculty of Engineering & Computing Sciences is thriving vigorously to move along the glorious path of academic excellence since its existence. This is providing opportunity to the students and faculties alike to excel in Education, Knowledge, Research Innovation, Skill and Patent, which are the main tools in Nation building.

I hope that participants will immensely benefit from the academic exchange of views & thoughts.

I wish this conference a great success.

Prof. (Dr.) R. K. Dwivedi
Conference General Chair & Principal
Faculty of Engineering
TMU, Moradabad

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National Conference

On

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative)

Ancient Mathematics and its Emerging Areas
AMEA-2024

Organized by
Department of Mathematics, Faculty of Engineering
Teerthanker Mahaveer University, Moradabad, India

PROGRAMME SCHEDULE

(Wednesday, 24th April, 2024)

(Venue: LT-6)

S. No.	EVENT	TIME
1.	**Inauguration by lighting the lamp- Maa Saraswati Vandana**	**10:30 AM**
2.	Welcome note by Ms. Chhavi Gupta	**10:35 AM**
3.	**Conference Theme and Welcome Address:** Prof. (Dr.) Rakesh Kr. Dwivedi, Conference General Chair, AMEA-2024	**10:40 AM**
4.	**Address:** Dr. Aditya Sharma, Registrar TMU, Moradabad	**10:50 AM**
5.	**Address:** Dr. Manjula Jain, Dean Academics, TMU, Moradabad	**10:55 AM**
6.	**Address:** Prof. V K Jain, Hon'ble Vice Chancellor, TMU, Moradabad	**11:00 AM**
7.	**Chief Guest Address:** Prof. (Dr.) Rashmi Bhardwaj, Guru Gobind Singh Indraprastha University, New Delhi	**11:10 PM**
8.	**Keynote Address:** Prof. Nagendra Kumar, M.M.H. College, Ghaziabad	**12:00 PM**
9.	Honouring session (Memento) for the Chief Guest & Keynote Speaker	**12:30 PM**
10.	High Tea	**12:35 PM**
	SESSION-I	
	Venue- LT-6, Ground Floor, FoE	
11.	**Paper Presentation** **Session Chairs:** **1.** Dr. Navneet Kumar **2.** Dr. Narottam S Chauhan	**01:00 PM-02:00 PM**
	LUNCH BREAK	**02:00 PM-02:30 PM**
	SESSION- II	
	Venue A- LT-6, Ground Floor, FoE	
12.	**Paper Presentation** **Session Chairs:** **1.** Dr. Ajay K Upadhyay **2.** Dr. Kamesh Kumar	**02:30 PM-04:30 PM**

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	Venue B- Committee Room, Ground Floor, FoE	
13.	**Paper Presentation** **Session Chairs:** **1.** Dr. Gandharv Kumar **2.** Dr. Alok Gahlot	**02:30 PM-04:30 PM**
	Valedictory Session	
14.	**Conference Report:** Dr. Vipin Kumar, Conference Convener, AMEA-2024	**4:30 PM**
15.	**Vote of Thanks:** Dr Abhinav Saxena, Conference Secretary, AMEA-2024	**4:35 PM**

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Teerthanker Mahaveer University, Moradabad, India

Presentation Schedule

(Wednesday, 24th April, 2024)

Google Meet Link: https://meet.google.com/vrb-qykv-ofw

SESSION-I (Time: 01:00 PM-02:00 PM)

Venue- LT-6, Ground Floor, FoE

Session Chairs:
1. Dr. Navneet Kumar
2. Dr. Narottam S. Chauhan

S. No	Paper ID	Authors	Title
1.	**P-AMEA-211**	Jamkhongam Touthang	ORBITS OF OPERATORS AND WAVELET FRAMES
2.	**P-AMEA-212**	Vipin Kumar	FINDING MAXIMUM SUM OF THE NUMBER USING SOME PARTICULAR GRAPHS
3.	**P-AMEA-213**	[1]Kamal Kumar [2]Tamanna kumara	ANALYSIS OF SOME NEW INVARIANTS IN FUZZY GRAPHS
4.	**P-AMEA-214**	[1]Ankit Kumar [2]Goyal [3]Kamal Kumar [4]Mohini	AN INVENTORY MODEL WITH INVENTORY LEVEL INVENTORY-DEPENDENT DEMAND FOR DECAYING ITEMS INCORPORATED WITH PARTIAL BACKLOGGING
5.	**P-AMEA-215**	[1]Kamal Kumar [2]Mohini [3]Monu Kumari	INVENTORY MATHEMATICAL MODELLING INCORPORATES STOCK-DEPENDENT DEMAND AND VARIABLE HOLDING COSTS WITH SALVAGE VALUE
6.	**P-AMEA-216**	Dr. Atma Nand	OPTIMIZING INVENTORY MANAGEMENT: A COMPREHENSIVE MODEL FOR DETERIORATING ITEMS WITH PARTIAL PAYMENT DYNAMICS AND BACKORDERING
7.	**P-AMEA-217**	Mohit Kumar Dulyani	FIXED POINT RESULTS FOR FUZZY METRIC SPACES WITH INTEGRAL COMTRACTIVE OPERATORS

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8.	**P-AMEA-218**	L. K. Tiwari	BIANCHI TYPE-V COSMOLOGICAL MODEL WITH COSMOLOGICAL CONSTANT Λ IN GENERAL RELATIVITY
9.	**P-AMEA-219**	[1]Vikas Kumar [2]Garima Tomar [3]Pallavi Bisht	APPLICATIONS AND PROPERTIES OF AGE SPECIFIC DISCRETE MATRIX MODEL IN HUMAN POPULATION DYNAMICS
10.	**P-AMEA-220**	Dr. Ankur Nehra	PERFORMANCE ANALYSIS OF EDWARDS AND TWISTED EDWARDS ELLIPTIC CURVES USING ANCIENT INDIAN VEDIC MATHEMATICS
11.	**P-AMEA-221**	Hemant Kumar Mishra	RINGS OF SATURN AND ITS MOON
12.	**P-AMEA-222**	[1]Kamal Kumar [2]Vinod Kumar [3]Seema	COMPARATIVE ANALYSIS OF SECURE AUTHENTICATION FRAMEWORKS FOR COMMUNICATION NETWORKS

LUNCH BREAK (Time: 02:00 PM-02:30 PM)

SESSION-II (Time: 02:30 PM-04:30 PM)

Venue A- LT-6, Ground Floor, FoE

Session Chairs:
1. Dr. Ajay K Upadhyay
2. Dr. Kamesh Kumar

S. No	Paper ID	Authors	Title
13.	**P-AMEA-225**	[1]Vivek Kumar Chauhan [2]Vivek Tyagi [3]Pradeep Chaudhary [4]Vikas Tyagi	A SOUND BASE STUDY ON META ANALYSIS TECHNIQUE AND PERFORM STATISTICAL ANALYSIS OF PANDEMIC DISEASE DATA OF VARIOUS COUNTRY
14.	**P-AMEA-226**	Smarajit Maji	OPTIMAL INTERVENTION STRATEGIES FOR BURULI ULCER DISEASE: A DYNAMIC SIR-SI MODEL CONSIDERING IMMUNITY LOSS AND ARSENIC EXPOSURE IN SURFACE WATER
15.	**P-AMEA-227**	[1]Anu Chohla [2]Sunita Rani	DEFORMATION OF AN ORTHOTROPIC STRATUM OVERLYING A ROUGH RIGID BASE SUBJECTED TO NORMAL LINE LOADING
16.	**P-AMEA-228**	[1]Saurabh Kumar [2]Dr. Hema Rani [3]Veenita Sharma	MATHEMATICAL MODELING AND NONLINEAR DYNAMICS: A CONCISE OVERVIEW
17.	**P-AMEA-229**	[1]Veenita Sharma [2]Saurabh Kumar [3]Dr. Hema Rani	A TWO WARE-HOUSE EOQ MODEL WITH DETERIORATION AND SHORTAGES USING PARTICLE SWARM OPTIMIZATION, BASED ON SOFT COMPUTING
18.	**P-AMEA-230**	[1]Dr. Hema Rani, [2]Veenita Sharma [3]Saurabh Kumar	INNOVATIVE SOLUTIONS FOR INDUSTRIAL WATER PURIFICATION: ADDRESSING THE CHALLENGES OF CONTAMINATED WATER MANAGEMENT
19.	**P-AMEA-231**	[1]Satpal Singh [2]Satish Kumar	SUPPLY OF COMMODITIES IN CONTAINMENT ZONE DURING COVID-19 BASED ON NOVEL DISSIMILARITY MEASURE IN PICTURE FUZZY ENVIRONMENT

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20.	**P-AMEA-232**	Varsha Jaiswal	SOLVING FUZZY TRANSPORTATION PROBLEM BY MV METHOD
21.	**P-AMEA-233**	[1]Dr. Vinod Bhatia [2]Dr. Vishvajit Singh [3]Chinky	FIXED POINT THEOREM FOR PAIRS OF WEAKLY COMMUTING MAPPINGS
22.	**P-AMEA-234**	[1]Dr. Vinod Bhatia1 [2]Dr. Vishvajit Singh [3]Jinam	EXISTENCE OF FIXED POINT IN PROBABILISTIC METRIC SPACES
23.	**P-AMEA-235**	[1]Kamal Kumar [2]Reena Devi [3]Pardeep Goel	IDENTIFYING THE KEY ELEMENTS OF MATHEMATICAL MODELS FOR THE SPREAD OF MALWARE
24.	**P-AMEA-236**	[1]Priyanka Jain [2]Vipin Kumar	PREDICTIVE ANALYSIS OF STEEL STOCKS USING R
25.	**P-AMEA-237**	[1]Divya Jain [2]N. S. Chauhan	WAVELET-BASED APPROXIMATION OF FRACTIONAL THREE-LAKE POLLUTION DYNAMICS USING MITTAG-LEFFLER KERNELS: A NOVEL BOUBAKER WAVELET METHOD APPROACH
26.	**P-AMEA-238**	[1]Aditi, Keshav Kumar [2]Ram Wadhwani [3]Himanshu Singh [4]N.S. Chauhan	IMAGE FUSION OF WILDLIFE SPECIES USING DISCRETE WAVELETS
27.	**P-AMEA-239**	[1]Alpana Srivastava, [2]Ajit Kumar [3]Akhilesh Chandra Pandey	EFFECT OF DARCY NO. ON MICROPOLAR FLUID FLOW IN POROUS REGION
28.	**P-AMEA-240**	[1]Jatin Kumar Gangwar [2]Ishika Yadav [3]Akanksha Sharma [4]Deepashikha Yadav, [5]Alok Kumar Gahlot	APPLICATION OF MINIMUM SPANNING TREE IN SPREADING WATER PIPELINE
29.	**P-AMEA-241**	[1]Shiva Sharma [2]Abhinav Saxena	APPLYING QUEUING THEORY TO REDUCE WAITING TIME AT ATMs
30.	**P-AMEA-243**	[1]Anmol Gupta [2]Vipin Kumar [3]Abhinav Saxena	MARKOV PROCESSES AND MATHEMATICAL MODELING TECHNIQUES FOR ASSESSING COMMUNICATION SYSTEM RELIABILITY
31.	**P-AMEA-244**	[1]Rashi Arya [2]Vipin Kumar [3]Abhinav Saxena	MULTI-OBJECTIVE SOLID TRANSPORTATION PROBLEM INVOLVING FIXED CHARGE UNDER RANDOM UNCERTAIN FUZZY ENVIRONMENT
32.	**P-AMEA-245**	[1]Aadarsh Chaudhary [2]Kamesh Kumar	A UNIFORM FORMULA FOR EFFECTIVE COMPUTING AND STRUCTURAL UNDERSTANDING FOR VARIOUS GRAPHS TYPES AND USES
33.	**P-AMEA-246**	[1]Puneet Kumar, [2]Abhinav Saxena, [3]Kamesh Kumar	OPTIMIZING INVENTORY IN TWO-WAREHOUSE WITH SHIFTING DEMAND PATTERNS FOR DETERIORATING ITEMS
34.	**P-AMEA-247**	[1]Chhavi Gupta [2]Vipin Kumar [3]Kamesh Kumar	OPTIMIZING WAREHOUSE SPACE ALLOCATION: A REVIEW AND APPLICATION OF LINEAR PROGRAMMING MODELS

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35.	**P-AMEA-248**	Khyati	OPTIMIZING INVENTORY MANAGEMENT FOR EXPONENTIAL DEMAND AND DETERIORATING ITEMS WITH TIERED DISCOUNT STRATEGIES
36.	**P-AMEA-249**	[1]Sarthak Goyal [2]Vipin Kumar	A METHOD TO MATHEMATICAL MODELING FOR GREEN SUPPLY CHAIN DESIGN THAT IS BASED ON AN OPTIMIZATION MODEL WITH MULTIPLE OBJECTIVES

SESSION-II (Time: 02:30 PM-04:30 PM)

Venue B- Committee Room, Ground Floor, FoE

Session Chairs:
1. Dr. Gandharv Kumar
2. Dr. Alok Gahlot

S. No	Paper ID	Authors	Title
37.	**P-AMEA-250**	[1]Khyati [2]Ashendra Kumar Saxena	EOQ INVENTORY MODEL FOR LINEARLY INCREASING DEMAND AND NON-INSTANTANEOUS DETERIORATION WITH TWO-LEVEL TRADE CREDIT
38.	**P-AMEA-251**	[1]Shivam kumar [2]Ajay Kumar Upadhaya	MATHEMATICAL MODELING OF METAMATERIAL PROPERTIES
39.	**P-AMEA-252**	[1]Avnish Yadav [2]Abhay Kumar [3]Bharat Pandey	OPTIMIZING THE COST AND ROUTE OF TRANSPORTATION WITH LINEAR PROGRAMMING THROUGH PYTHON PROGRAMMING
40.	**P-AMEA-253**	[1]Stuti Gupta [2]Kamesh Kumar	FACTORS AFFECTING INFERTILITY ACROSS URBAN MILLENNIAL: A STRUCTURAL EQUATION MODELING BASED APPROACH
41.	**P-AMEA-254**	[1]Amisha Jain [2]Anchal Yadav [3]Aniket Gupta [4]Vipin Kumar	ANALYZING 3D GRAPH PLOTTING AND REPRESENTATION TECHNIQUES USING MATLAB
42.	**P-AMEA-255**	[1]Tanisha Gupta [2]Monika Ray [3]Maneesh Chauhan	STUDY OF AIR QUALITY INDEX
43.	**P-AMEA-256**	[1]Manasvi Ruhela [2]Itika Verma [3]Amandeep Singh [4]kamesh Kumar	A STUDY ON THE APPLICATION OF HAMILTONIAN GRAPH
44.	**P-AMEA-257**	[1]Pallavi Gupta [2]N. S. Chauhan	INNOVATIVE METHOD FOR UTILIZING BELL WAVELET TO SOLVE DUAL FRACTIONAL INTEGRO DIFFERENTIAL EQUATION PROBLEMS
45.	**P-AMEA-258**	[1]Ramgopal Singh [2]N. S. Chauhan	A TECHNIQUE TO SOLVE COUPLED PARTIAL DIFFERENTIAL EQUATIONS THROUGH COUPLED MULTI-WAVELETS
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ABSTRACT

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ORBITS OF OPERATORS AND WAVELET FRAMES

Jamkhongam Touthang

Department of Applied Mathematics, Delhi Technological University, Delhi 110042, India

Email: jamkhongamtouthang@dtu.ac.in

Studying wavelets within the framework of an orthonormal basis presents certain limitations. The concept of frames generalizes wavelet analysis. Wavelet frames find various signal processing applications, including compression, denoising, filtering, signal detection, and feature extraction. A recent research in frame theory focuses on operator representations of frames, a study that connects frames and operator theory. However, obtaining such representations through bounded operators raises subtle challenges. In this manuscript, we aim to address some problems concerning operator representations of frames, particularly wavelet frames.

Keywords: *Orbits of operators, wavelet frames, operator representations of frame*

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FINDING MAXIMUM SUM OF THE NUMBER USING SOME PARTICULAR GRAPHS

Vipin Kumar

Department of Mathematics, Zakir Husain Delhi College, University of Delhi, New Delhi, India

Email: vipin.kmath@zh.du.ac.in

A graph is a combination of set of vertices and edges. The general notation of graph is $G=(V_G, E_G)$. In graph theory a new concept is graph labeling in which the labeling of graph gives a new definition to a given graph and the graph becomes more useful than its unlabelled structure. A function χ from the set of natural numbers N whose range is a subset of real numbers R is called a sequence. In this paper, we will concern with sequence in R and discuss what we mean by the largest sum numbering for an n-gon, trees and bipartite graph conjecture. We also show an example that the inverse transformation of largest sums numbering is largest sum numbering.

Keywords: *Graph labeling, n-gon, trees, bipartite graph, sequence.*

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ANALYSIS OF SOME NEW INVARIANTS IN FUZZY GRAPHS

[1]Kamal Kumar, [2]Tamanna kumara

Department of Mathematics, Baba Mastnath University, Rohtak

Email: [2]tamannasepkumari@gmail.com

In the classical or crisp relation, there is clarity on the existence of interconnectedness or relationship between the elements of multiple sets which is depicted by the existence (1) or inexistence (0) of a relationship. In crisp sets and relations, an element belongs clearly to a collection or not. There is an existence of a clear-cut definition of the properties of acceptable elements and as such, only discrete criteria are acceptable. In technical and practical scenarios, discrete criteria are not always applicable to every situation, and as such, the fuzzy (non-distinct, ambiguous) nature of group belonging becomes crucial. In fuzzy relations, less clarity exists in the discrete association between the elements of multiple sets, and as such, requires more complexity in computation. To identify the level of interconnectedness or association in a fuzzy relation, degree of membership is used. The fuzzy relation depicts the strength of connection between the elements of multiple sets.

Keywords: *Fuzzy graph, Multiple sets, Fuzzy relations.*

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AN INVENTORY MODEL WITH INVENTORY LEVEL INVENTORY-DEPENDENT DEMAND FOR DECAYING ITEMS INCORPORATED WITH PARTIAL BACKLOGGING

Ankit Kumar Goyal[1], Kamal Kumar[2], Mohini[3*]

[1]*Department of Mathematics, Swami Vivekanand Subharti University, Meerut*
[2,3]*Department of Mathematics, Baba Mastnath University, Rohtak*

Email: mohini.rs@bmu.ac.in

An inventory model for seasonal products where demand depends on inventory levels, for decaying items incorporated with partial backlogging is developed in this paper. All these properties of inventory are realistic in view of seasonal products like cold drinks, ice creams, and seasonal fruits like mango watermelon, etc. To authenticate the concept and model a numerical example is illustrated.

Keywords: *Inventory, Inventory level dependent demand, Deterioration, Partial backlogging.*

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INVENTORY MATHEMATICAL MODELLING INCORPORATES STOCK-DEPENDENT DEMAND AND VARIABLE HOLDING COSTS WITH SALVAGE VALUE

[1]Kamal Kumar, [2]Mohini, [3]Monu Kumari

Department of Mathematics, Baba Mastnath University, Rohtak

Email: [3]monukumari9999@gmail.com

In the current business environment, arousing customer interest through inventory display in malls, retail establishments, etc. is a significant concern for all companies. In this paper, the inventory model with non-instantaneous deteriorating items is analyzed with a mathematical model. It is assumed that the holding cost function decreases linearly with time. It is assumed that the demand rate in this study is dependent on the stock. The optimal profit and optimal order quantity of the developed models are determined in this paper. Sensitivity analysis and numerical example is presented to verify whether the key parameters of the developed mathematical model are optimal for the optimal profit function

Keywords: *Inventory, Deteriorating items, Ordering cost, Purchasing cost, Holding cost.*

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Optimizing Inventory Management: A Comprehensive Model for Deteriorating Items with Partial Payment Dynamics and Backordering

Dr. Atma Nand

Department of Mathematics, School of Applied and Life Sciences, Uttaranchal University, Dehradun, Uttarakhand-248007

Email: atmanand.prasad@gmail.com

Manufacturers and distributors typically utilize installment plans to allow smooth transactions and payment for items in real-world scenarios. For example, distributors typically supply manufacturers with partial prepayments in a series of installments, while providing retailers the opportunity to withhold payment until after they have received the products. Our work focuses on enhancing supply chain dynamics using the Economic Order Quantity (EOQ) model. Specifically, we consider instances where there are partial downstream delayed payments and partial upstream advance payments for goods that deteriorate with time. We explore three essential factors:

Shortage Mitigation: Guaranteeing the absence of shortages in the supply chain. Full Backordering: Enabling the capacity to fulfill all backorders in order to meet demand. Implementation of partial backordering to properly manage fluctuations in demand. In all these models, we rigorously verify the convexity of the cost functions and find explicit optimal solutions for the choice variables. These solutions offer in-depth analysis and suggestions for improving inventory management, cost control, and cash flow management across the supply chain. In order to test our theoretical findings and provide practical management assistance, we conduct computational examples that highlight the use of these optimal strategies in real-life settings, resulting in improved operational efficiency and profitability.

Keywords: *Optimized Inventory Model, Comprehensive Inventory Model, Dynamic Partial Payments, Backordering Inventory Model, Convex Cost Function*

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FIXED POINT RESULTS FOR FUZZY METRIC SPACES WITH INTEGRAL COMTRACTIVE OPERATORS

Mohit Kumar Dulyani

Government Polytechnic Jansath, Muzaffarnagar, Uttar Pradesh

Email: mkdgkv@gmail.com

In this article, we introduced the possibility for two classes of summarized integral $\alpha -$ $\psi -$ contractive maps for fuzzy metric space. We have broadened the after effects of Karapinar et al. also, demonstrated some related results with fixed point state for fuzzy complete metric spaces. Our outcomes have demonstrated the presence and unity of fixed point to such mappings for fuzzy complete metric spaces.

Keywords: *Fixed Point, Fuzzy Metric Spaces, Operators*

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BIANCHI TYPE-V COSMOLOGICAL MODEL WITH COSMOLOGICAL CONSTANT Λ IN GENERAL RELATIVITY

L. K. Tiwari

Department of Mathematics, University Institute of Sciences, Chandigarh University, Mohali Punjab, India

Email: laxmiallahabad@gmail.com

We have studied the Bianchi type-V cosmological model with a decaying cosmological constant and perfect fluid. By solving the Einstein field equations under the condition $\Lambda(t) = 3\beta H^2$, we have found that the cosmological term, which measures the energy of empty space, creates a repulsive force that counteracts the gravitational pull between galaxies. As a result, the cosmological model expands exponentially with cosmic time t. We have also explained the physical and kinematical properties of this cosmological model.

Keywords: *Einstein field equation, cosmological model.*

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APPLICATIONS AND PROPERTIES OF AGE SPECIFIC DISCRETE MATRIX MODEL IN HUMAN POPULATION DYNAMICS

[1]Vikas Kumar*, [2]Garima Tomar, [3]Pallavi Bisht

[1,3]Department of Mathematics, School of Applied and Life Sciences, Uttaranchal University, Dehradun- 248007, Uttarakhand, India.
[2]School of Allied Sciences, Dev Bhoomi Uttarakhand University, Dehradun- 248007 Uttarakhand, India

[1]Email Id: vikas.mathematica@gmail.com

This Paper considers a modified Leslie Matrix Population Model for the study of Age Specific density dependence population dynamics. Some properties and results from Leslie matrix and its eigen values are discussed. In the application part of this model, we constructed a Leslie matrix that project the age-specific density dependence population of India for every five-year interval between 2011 and 2051. We demonstrate the effectiveness of this model and to verify the accuracy of this model, we compared the population data calculated by Leslie model with the Census data, Office of Registrar General, Govt. of India. All the result are given in tabular form and compared in graphical form.

Keywords: *Age Specific, Eigen Values, Human Population Dynamics, Population density, Leslie Matrix Model.*

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PERFORMANCE ANALYSIS OF EDWARDS AND TWISTED EDWARDS ELLIPTIC CURVES USING ANCIENT INDIAN VEDIC MATHEMATICS

Dr. Ankur Nehra

Department of Mathematics, Dhanauri P.G. College, Dhanauri, Haridwar, Uttarakhand, 247667, India

Email Id: nehra.ankur648@gmail.com

This study uses vedic math methodologies to explain several well-implemented algorithms for point addition and point doubling for the Edwards elliptic curves. In particular, we improve timings in the Edwards elliptic curve cryptography workloads. To be more precise, we use Dvandva-yoga for squaring any digit and Urdhva-tiryagbhyam for duplication in ancient math. We give two cryptography formulas for Edwards elliptic curves: Point Addition and Point Doubling. We find that, when compared to the conventional method, the old science-based scheme performs better in terms of speed, handling time, and power consumption of multipliers. To calculate augmentations and determine using 16- and 32-bit numbers, the coding and amalgamation are completed in MATLAB. A few Old Mathematical techniques were investigated for their effects on elliptic curves, and the results are explained with tables and graphics. We discuss these improvements' implications for elliptic curve encryption.

Keywords: *Finite field, UTT, DYT, EEC, Points addition, Point doubling.*

MSC: *94A60, 14G50*

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RINGS OF SATURN AND ITS MOON

Hemant Kumar Mishra

Department of Mathematics, Chatra College, Chatra (A constituent unit of Vinoba Bhave University), Hazaribag (Jharkhand), India.

Email: hemumishra@gmail.com

हमारे सौरमण्डल में कुल 8 ग्रह हैं जिनके नाम सूर्य से बढती दूरी के अनुसार हैं – बुध, शुक्र, पृथ्वी, मंगल, बृहस्पति, शनि, अरुण और वरुण। पूर्व में यम (Pluto) को भी ग्रह माना जाता था किन्तु बाद में यम में ग्रहों की विशेषता न होने के कारण इसको ग्रहों की सूचि से बाहर कर दिया गया। मंगल तथा वृहस्पति के बीच 1 मीटर से लेकर 4 किमी0 व्यास तक के पत्थर हैं जो सूर्य के चक्कर लगाते हैं। इन्हें हम क्षुद्रग्रह घेरा (Asteroid Belt) कहते हैं। इस घेरा व सूर्य के बीच के ग्रह ठोस हैं तथा इसके बाद के ग्रह गैसीय हैं। इन सभी 8 ग्रहों में केवल पृथ्वी पर ही जीवन उपलब्ध है। मंगल ग्रह पर जीवों के लिए आवश्यक परिस्थितियों पर खोज हो रही है। अन्य सभी ग्रहों पर जीवन नहीं है। वृहस्पति सबसे बड़ा ग्रह है। शनि ग्रह के चारों तरफ ढेर सारे छल्ले हैं तथा शनि ग्रह के उपग्रहों की संख्या भी सबसे अधिक है। इन्ही सब कारणों से वैज्ञानिकों का आकर्षण शनि ग्रह की तरफ ज्यादा हुआ और विश्व वैज्ञानिक समुदाय ने पहले तो नग्न आखों से फिर बाद में अंतरिक्ष खोज यान (Probes) भेज कर शनि ग्रह के बारे में जानने की कोशिश की ।

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COMPARATIVE ANALYSIS OF SECURE AUTHENTICATION FRAMEWORKS FOR COMMUNICATION NETWORKS

Kamal Kumar[1], Vinod Kumar[2], Seema[3]

[1,3]*Department of Mathematics, Baba Mastnath University, Rohtak-124021, India*
[2]*Department of Mathematics, Shyam Lal Collage, University of Delhi, New Delhi-110032, India*
Email: kamalkumar4maths@gmail.com; vinod.iitkgp13@gmail.com

Since the rise of digital communication, the need for secure robust authentication frameworks has been increasing. This paper provides the deep analysis of the prominent authentication frameworks which aim to ensure security in the online communication. The paper reviews the various aspects of the authentication frameworks and provides a comparative view of the effectiveness of the various frameworks. The study highlights the strengths and weakness in the existing authentication networks and provides direction for the future research that may help in designing the authentication techniques as per the latest trends and requirements. There are various challenges that are prevalent in the authentication techniques and models which need to be addressed. This research emphasizes on the need of remediating these challenges and motivates the researchers, practitioners, and academicians to do more research in this field to manage the evolving security threats.

Keywords: *Attack, Authentication, Encryption, Frameworks, Scheme, Security*

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A SOUND BASE STUDY ON META ANALYSIS TECHNIQUE AND PERFORM STATISTICAL ANALYSIS OF PANDEMIC DISEASE DATA OF VARIOUS COUNTRY

Vivek Kumar Chauhan[1], Vivek Tyagi[2], Pradeep Chaudhary[3], Vikas Tyagi[1]

[1]*Department Of Statistics Meerut College Meerut-250004 India*
[2]*Department Of Statistics NAS College Meerut-250004 India*
[3]*Department Of Statistics CCS University Meerut 250004 India*
[1]*Department Of Statistics Meerut College Meerut-250004 India*

Email: vivekstats182@gmail.com

The paper deals the perception of meta-analysis and its compositions. We establish how the meta-analysis is recycled In applied approach and especially tends to human dimension approach. In the present scenario the social scientist, agriculture scientist, Medical Scientist have their outcomes and convey a reference of health Indictor used in health analysis would ensure the policymaker uses the information and perform the best approximate analysis relevant the context of meta-analysis and use this making the policy in future. We discuss the merit of meta-analysis and did the statistical analysis of total data of covid-19 in 2020-21.

Keyword: *Effect Size, Disappear Data, odds ratio, Heterogeneity.*

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OPTIMAL INTERVENTION STRATEGIES FOR BURULI ULCER DISEASE: A DYNAMIC SIR-SI MODEL CONSIDERING IMMUNITY LOSS AND ARSENIC EXPOSURE IN SURFACE WATER

Smarajit Maji

Agriculture & Ecological Research Unit, Indian Statistical Institute, 203, B.T. Road, Kolkata-700108, W.B., India

Buruli ulcer (BU) is a chronic, debilitating disorder of the skin that also affects the bones and is caused by *Mycobacterium ulcerans(MU)*. According to the World Health Organization (WHO), it is the third most common mycobacteriosis in humans after tuberculosis and leprosy. The disease is found to be associated with contaminated water, and its transmission involves human beings and water bugs (vectors). In this research article, we have mentioned a new non-linear mathematical model for the transmission dynamics of *Mycobacterium ulcerans* infection in humans as well as water bugs. The model is an amalgamation of two sub-models. The first one is for the human population, and the second one is for the environment. Water contamination with arsenic was addressed as a model variable. In this study, we have discovered one route of transmission that occurs through water bugs. Here we assume that the total population of host and vector is both non-constant. Here, we have used the next-generation matrix operator method to derive the basic reproduction number (R_0). By using Ruth-Hurwitz criteria, it has been proven that the Buruli-free equilibrium point is locally asymptotically stable when $R_0 < 1$ and unstable when $R_0 > 1$. The model shows a forward trans-critical bifurcation around $R_0 = 1$. We have applied optimal control to the model for analyzing the transmission dynamics of MU infection to humans, water bugs, and contaminated water. Here we also applied Pontryagin's maximum principle to characterize the optimal levels of the controls. The results of optimal are solved numerically using MATLAB software. The results proved that the optimal combination of three controls (use of protective cloths and health education for prevention, use of insecticide to kill water bugs, and reduction of water contamination by reducing arsenic in water) significantly minimizes the MU infection in the population. Finally, numerical reenactments are done graphically to illustrate energetic behaviour.

Keywords: *Arsenic, Mycobacterium ulceren, Water bug, Basic reproduction number, Stability analysis, Optimal control theory.*

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DEFORMATION OF AN ORTHOTROPIC STRATUM OVERLYING A ROUGH RIGID BASE SUBJECTED TO NORMAL LINE LOADING

Anu Chohla[1], Sunita Rani[2]

Department of Mathematics Guru Jambheshwar University of Science and Technology Hisar-125001, INDIA

[1]*Email: anuchohla.ac@gmail.com*

We obtained the analytical expressions for a deformation of homogeneous, elastically orthotropic stratum having finite thickness lying over a rough-rigid base subjected to surface loads. We have considered the antiplane strain case here. The integral form expressions for the stresses and displacement at arbitrary point of the layer lying over a rough-rigid base have been obtained, which have been solved analytically with the help of integral transform tables. The displacement and the stresses have been plotted for the two orthotropic materials: Topaz and Barytes and compared with the isotropic case.

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MATHEMATICAL MODELING AND NONLINEAR DYNAMICS: A CONCISE OVERVIEW

Saurabh Kumar[1], Dr. Hema Rani[2], Veenita Sharma[3]

Department of Applied Sciences & Humanities, IMS Engineering College Ghaziabad

[1]*Email: Saurabh.mathematics@gmail.com*

This paper provides a brief yet comprehensive examination of mathematical modeling and nonlinear dynamics. It discusses the foundational aspects of mathematical modeling, highlighting its role in capturing real-world phenomena. The paper also explores the complexity of nonlinear systems and how mathematical modeling coupled with nonlinear dynamics offers insights into emergent phenomena. It concludes by emphasizing the importance of interdisciplinary collaboration in addressing challenges posed by complex systems.

Keywords: *Mathematical modeling, nonlinear dynamics, differential equations, chaos theory, emergent phenomena, interdisciplinary collaboration*

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A TWO WARE-HOUSE EOQ MODEL WITH DETERIORATION AND SHORTAGES USING PARTICLE SWARM OPTIMIZATION, BASED ON SOFT COMPUTING

Veenita Sharma, Saurabh Kumar, Dr. Hema Rani

Department of Applied Sciences & Humanities, IMS Engineering College Ghaziabad

Email: vinitasharma129@gamil.com

This study investigates a two-warehouse inventory model for degrading commodities, where rented warehouses offer better preservation facilities than owned ones, resulting in higher inventory costs. Both holding costs and demand are variable, and shortages are allowed in owned warehouses, with a portion carried over to the next replenishment cycle. The paper focuses on time-dependent demand and variable holding costs, increasing with the ordering cycle length in rented warehouses and remaining constant in owned ones after a set time. Goods are released in bulk patterns with minimal transportation costs. The model is solved using Particle Swarm Optimization with variable population size, incorporating superior offspring in subsequent generations as a subset of the parent population

Keywords: *Two warehouses, Instantaneous deterioration, Time dependent Demand, Variable holding cost, shortages and Particle Swarm Optimization*

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INNOVATIVE SOLUTIONS FOR INDUSTRIAL WATER PURIFICATION: ADDRESSING THE CHALLENGES OF CONTAMINATED WATER MANAGEMENT

Dr. Hema Rani [1], Veenita Sharma [2], Saurabh Kumar[3]

Department of Applied Sciences & Humanities, IMS Engineering College Ghaziabad

[1]Email: Hema_iitr@yahoo.co.in

Rapid industrial growth results in substantial waste, contaminating nearby water sources and posing health risks by polluting drinking water. Filtering methods, while prevalent, struggle to cope with the high levels of toxins present. This study presents solutions for effectively purifying contaminated water, addressing the pressing challenge of industrial waste management. By proposing innovative purification techniques, it aims to mitigate the adverse impacts of industrial waste on water quality and public health, thus providing a pathway towards sustainable industrial practices and safeguarding the well-being of communities reliant on clean water sources.

Keywords: *Contaminated, Industrial, Waste, Water*

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SUPPLY OF COMMODITIES IN CONTAINMENT ZONE DURING COVID-19 BASED ON NOVEL DISSIMILARITY MEASURE IN PICTURE FUZZY ENVIRONMENT

Satpal Singh[1], Satish Kumar [2]

[1]*Department of Mathematics, IIHS, Kurukshetra University, Kurukshetra, Haryana, India, 136119.*

[2]*Department of Mathematics, Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, Haryana, India, 133207.*

Email: satpal.iihs@kuk.ac.in

The Indian administration has faced a critical time in the epidemic of COVID-19, which reported the first case on 30 January 2020, and in China, it was reported in December 2019. So, it became important to maintain the supply of needed commodities in containment zones in the country. The outbreak of COVID-19 led to the Indian administration imposing restrictions on human movement. As a result, ensuring the supply of essential commodities in containment and hotspot zones throughout the country became necessary. A new study suggests exponential dissimilarity measures to realize the distribution and demand for commodities in these areas during the COVID-19 spread. The study employs dissimilarity measures established on the exponential function under Picture fuzzy sets, proposed by Yager. The aim is to find the most needed commodity in the impacted areas and guarantee its distribution in containment and hotspot zones. The projected route of grocery distribution to distinct residencies in the containment area depends on the dissimilarity measure between individual residences and the necessary goods. Numerical computations validate the proposed measures, and the results are compared to verify their effectiveness.

Keywords: *COVID-19, fuzzy sets, picture fuzzy set, decision making, distance measure, dissimilarity measure*

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SOLVING FUZZY TRANSPORTATION PROBLEM BY MV METHOD

Varsha Jaiswal

Department of Physical Sciences, M.G.C.G.V Chitrakoot Satna, Madhya Pradesh

Email: varshajaiswal248@gmail.com

In a recent paper a new proposed approach namely called MV method. This method is used to solve any fuzzy transportation problems of any numbers like triangular trapezoidal pentagonal, hexagonal, heptagonal, and octagonal e.tc numbers using range ranking techniques. When we solve the fuzzy transportation problems using MV method, first we have to change their fuzzy transportation problem in to crisp cost table using range ranking technique. Then apply these steps of MV methods for finding their optimal solution. Generally, the use of range ranking techniques is to find the difference of maximum cost and minimum cost of fuzzy transportation table is called range ranking techniques. The relevant illustrations examples are given to justify the above proposed notation instruction.

Keywords: *Fuzzy Transportation Problem, Fuzzy logic, MV method, Range ranking techniques Hexagonal fuzzy number.*

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FIXED POINT THEOREM FOR PAIRS OF WEAKLY COMMUTING MAPPINGS

Dr. Vinod Bhatia[1], Dr. Vishvajit Singh[2], Chinky[3]

[1,3]*Department of Mathematics, Baba Mastnath University, Rohtak*
[2]*Department of Mathematics PDM University, Bahadurgarh*
[3]*Email: chinkyanika7318@gmail.com*

The aim of this paper is to prove a common fixed-point theorem for pairs of weakly compatible mappings satisfies some contraction condition. We prove here some results using different variants of weakly commuting mappings .At the end we give some supportive results.

Keyword: *weakly compatible mappings, fixed point, contraction, weakly commuting mappings.*

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EXISTENCE OF FIXED POINT IN PROBABILISTIC METRIC SPACES

Dr. Vinod Bhatia[1], Dr. Vishvajit Singh[2], Jinam[3]

[1,3]*Department of Mathematics, Baba Mastnath University, Rohtak*
[2]*Deptt. of Mathematics, PDM University, Bahadurgarh*

[3]*Email: jinuhooda@gmail.com*

The objective of this paper is to construct and prove some fixed-point results in probabilistic space. Probabilistic metric spaces have very useful properties such as openness of open balls. Due to its properties, we have worked in these spaces. In this way, we have generalized some well-known fixed-point theorems in probabilistic version. In addition, some interesting examples are constructed to illustrate our results.

Keywords: *probabilistic metric space, fixed point, commutative mappings.*

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IDENTIFYING THE KEY ELEMENTS OF MATHEMATICAL MODELS FOR THE SPREAD OF MALWARE

Kamal Kumar[1], Reena Devi[2], Pardeep Goel[3]

[1,2]*Department of Mathematics, Baba Mastnath University, Rohtak, India*

[3]*Department of Mathematics, Himalayan Garhwal University, Uttarakhand, India*

Email: reenalohan30@gmail.com

This study talks about three mathematical models of how malware spreads on a computer network so that the most important model parameters can be found. We discovered that each of the key characteristics for the three mathematical models is the "normal fatality rate," which is the percentage of nodes that collapse for causes other than being attacked by harmful items. The model's influencing parameters also include the data transmission rate, the quantity of novel nodes after the vulnerable category, and the pace at which sensitive nodes are added to the computer network. The results show that if you don't want to be attacked by harmful items, you need to use strong antiviral software.

Keywords: *Sensitivity analysis, Computer virus, PRCC, LHS, Mathematical model*

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PREDICTIVE ANALYSIS OF STEEL STOCKS USING R

Priyanka Jain, Vipin Kumar

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University,

Moradabad (Uttar Pradesh), India.

Email: priyanka.jain864@gmail.com

The stock market is a challenging investment. It is said that only risk-loving investors would choose to invest in the stock market, however, there is no denying that it is only one of the most highly rewarding modes of investment too. If the investor is well averse to the trends and has done the required search work about the stock, it makes the decision more confident and easier (however no forecast ensures a definite reality, thereis always scope for error and variance). One of the best investment opportunities is the steel business, some research shows this industry to have a market value of $7.0 billion in 2020 and estimates it to reach $38.8 billion by 2035. By the most recent data by WorldPopulation Review India ranks as the second highest steel producer in the world. In this study, we employ time series analysis where we use Auto Regressive Integrated Moving Averages (ARIMA) models to predict the movements of four significant Indian steel stocks, Tata Steel, JSW Steel, Steel Authority of India (SAIL), and Jindal Steel. This study examined the four stocks' historical trends over seventeen years, from 2005 to 2021, and created projections for the future. When the closing stock value is the dependent variable.The analysis revealed that the ARIMA model provided the greatest fit for predicting stockvalues. Except for the COVID-19 pandemic, when costs decreased, the graph grew and showed a rising trend every year. With the help of our R model, we made future predictions. However, no predictions can guarantee a future value. The model too has various limitations which make real-time implications difficult. The stock market is affected by various qualitative factors which cannot be put into numbers effectively alongside the fluctuations in the market which make it difficult to deploy such models which can capture each movement being well adhered to the data as well as being smoothfor analysis and forecasting purposes.

Keywords: *Stock Market, ARIMA Model, Future Value, Forecasting*

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WAVELET-BASED APPROXIMATION OF FRACTIONAL THREE-LAKE POLLUTION DYNAMICS USING MITTAG-LEFFLER KERNELS: A NOVEL BOUBAKER WAVELET METHOD APPROACH

Divya Jain , N. S. Chauhan

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India

Email: divyajain.scholar@tmu.ac.in

In this study, we present a novel approach to solving the three-lake pollution model by leveraging the Boubaker wavelet method in conjunction with the Mittag-Leffler kernel. We explore three distinct scenarios within the three-lake pollution model: periodic input, exponentially decaying input, and linear input. The inherent advantage of the Boubaker wavelet lies in its ability to achieve high accuracy with a minimal number of basis functions. Utilizing the collocation method, we transform the system of fractional differential equations governing the pollution dynamics into a set of algebraic equations, facilitating efficient numerical computations. To validate the reliability and efficiency of our proposed method, comprehensive convergence tests and error estimations are conducted.

Keywords: *Atangana-Baleanu derivative, Boubaker wavelet, Three lake pollution model, Fractional differential equation*

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IMAGE FUSION OF WILDLIFE SPECIES USING DISCRETE WAVELETS

Aditi, Keshav Kumar, Ram Wadhwani, Himanshu Singh, N.S. Chauhan

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India

Emails: aditichaudhary536@gmail.com

In this paper, we propose a modified image fusion technique using discrete wavelet transform. The proposed method takes multiple images at once and decomposes them into detailed coefficients at different scales. By deliberately, merging these coefficients using fusion techniques, a fused image is created, conserving significant features from all input images. The algorithm is crafted using MATLAB -R2022b version. The modified technique aids in wildlife monitoring and conservation and offers insights into wildlife habitats.

Keywords: *MATLAB, Image fusion, Wildlife monitoring*

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EFFECT OF DARCY NO. ON MICROPOLAR FLUID FLOW IN POROUS REGION

Alpana Srivastava[1], Ajit Kumar[1], Akhilesh Chandra Pandey[2]

[1]*Department of Applied Mathematics, Teerthankar Mahaveer University, Moradabad, Uttar Pradesh- 244001, India*

[2] *Department of Mathematics, Akbarpur Degree College under C.S.J.M. University, Kanpur, UttarPradesh- 209101, India*

Email: alpanasrivastava93@gmail.com

The current study examines the flow of micropolar fluid in a porous medium under the influence of Darcy number. The porous region exists between two plates through which incompressible micropolar fluid flows. The flow is steady, laminar, unidirectional and fully developed; the fluid is driven by the constant pressure gradient. Brinkman equation has been used to define the fluid flow in the region. The governing equations with our model are transformed into system of differential equations that have been solved analytically. The expression for fluid linear velocity, micro-rotational velocity and flow rate have been obtained in their closed form. Use linear solve in MATHEMATICA (10.3) software to solve the system of equations after applying boundary conditions. The Influence of associated parameters on velocity profile, micro-rotation and flow rate are represented graphically with the help of MATHEMATICA (10.3) software. This study may be convenient for groundwater infiltration, medical purposes, and reservoirs.

Keywords: *Micropolar fluid, MATHEMATICA, Darcy number*

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APPLICATION OF MINIMUM SPANNING TREE IN SPREADING WATER PIPELINE

Jatin Kumar Gangwar, Ishika Yadav, Akanksha Sharma, Deepashikha Yadav,
Alok Kumar Gahlot

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University,
Moradabad (Uttar Pradesh), India

Email: jatingangwar407@gmail.com

The system of urban water supply network is the important lifeline project of the city. With the continuous development of social economy, people are no longer satisfied with water supply requirements. People put forward higher requirements for the safety, reliability and economy of the water supply. Based on actual demands to solve the economic problems of water supply network we need to ensure the lowest costs in laying the pipelines. First, we need to establish a mathematical model of water supply network, so that we can use the knowledge of graph theory to solve this problem. The minimum spanning tree was used to ensure that costs are the lowest in the case of pipeline connectivity. Then using the Kruskal's algorithm to generate minimum spanning tree, finally an example was analyzed to verify its practicality, and the algorithm solved the problem of water supply network in laying pipelines successfully.

Keywords: *Kruskal' Algorithm, Minimum Spanning Tree, Water Pipeline*

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APPLYING QUEUING THEORY TO REDUCE WAITING TIME AT ATMs

Shiva Sharma, Abhinav Saxena

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India.

Emai: shivasharma8562@gmail.com

Automatic Teller Machine (ATM) services have become an important part of banking services across the world. We apply a queuing system to reduce waiting lines at ATMs. In this paper, a queuing model is used to solve this real-case scenario optimally. In Queuing theory, we analyze the basic characteristics and their application. There are many situations in our daily life when a queue is formed. The main objective of ATMs for banks is to keep away customers from coming to the bank and make the process easy for them to avoid the basic procedures they have to do in the banks. The main aim of the study is to develop a suitable queuing theory and simulation technique to optimize waiting lines at ATMs. We use Little's law to reduce waiting time in queues. Thus, to maintain the customers, the service time needs to be improved. In this paper, we analyze how queuing theory can be used to accurately predict the arrival rate of the customer and the service rate of the service facility.

Keywords: *Queuing theory, simulation, Little's law, arrival rate, services rate.*

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MARKOV PROCESSES AND MATHEMATICAL MODELING TECHNIQUES FOR ASSESSING COMMUNICATION SYSTEM RELIABILITY

Anmol Gupta, Vipin Kumar, Abhinav Saxena

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India.

Email: anmolgupta635@gmail.com

This research explores the use of Markov processes and mathematical modelling methods to assess the reliability of communication systems. Markov processes model the probabilistic shifts between different states in these systems, facilitating a thorough evaluation of reliability. Mathematical modelling is applied to measure and assess the influence of various factors on reliability, such as component failures, network congestion, and maintenance tasks. By combining Markov processes and mathematical models, this study introduces a robust framework for reliability assessment in communication systems, showcasing how this methodology efficiently detects weaknesses and enhances system performance. Real-world case studies and simulations are employed to demonstrate the practicality and advantages of these methods in communication system scenarios.

Keywords: *WCS (Wireless Communication System), Reliability, Mean Time to Failure, Mean Time between Failure, Markov Process.*

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MULTI-OBJECTIVE SOLID TRANSPORTATION PROBLEM INVOLVING FIXED CHARGE UNDER RANDOM UNCERTAIN FUZZY ENVIRONMENT

Rashi Arya, Vipin Kumar, Abhinav Saxena

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India.

Email: rashi2462000@gmail.com

The main aim of this paper is to optimize the multi-objective solid transportation problem including fixed charge (MOSTP) in uncertain environment. Also, includes random fuzzy parameters such as supply, demand, conveyance capacity, cost of transportation and cost of fixed charge. The MOSTP is approached as a decision-making framework aimed at optimizing the probabilistic value at risk (VaR), which integrates the concept of value at risk with possibilities and necessity measure theories. The deterministic form of constrained problem derived from this formulation is then solved using the generalized reduced gradient method (GRG) implemented in Lingo software. Numerical examples are presented to demonstrate the model's efficacy, along with sensitivity analysis.

Keywords: *Multi-objective solid transportation problem (MOSTP), Generalized reduced gradient (GRG), Value at risk (VaR), Random variables and crisp values.*

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A UNIFORM FORMULA FOR EFFECTIVE COMPUTING AND STRUCTURAL UNDERSTANDING FOR VARIOUS GRAPHS TYPES AND USES

Aadarsh Chaudhary, Kamesh Kumar

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India.

Email: aadarshchaudhary277@gmail.com

In Graph theory, eigenvalues are crucial because they provide insight into the characteristics of graphs. This abstract presents a new formula that incorporates adjacency matrix to compute eigenvalues in graph energy. The formula provides a methodology that works on a variety of graphs, increasing computational effectiveness. The accuracy of the equation in calculating eigenvalues is confirmed by computational validations and theoretical study. This work advances our knowledge of graph energy and helps with spectral characterization and structural analysis. Because of the equation's efficiency, network analysis, data science, and optimisation can benefit from real-world applications. The theoretical foundations and practical utility of graph theory are advanced by this study, which offers a coherent framework for eigenvalue calculation. Advances in a variety of domains dependent on graph analysis are fostered by its ability to provide researchers with deep insights into graph structures and spectral features.

Keywords: *Graph energy; eigenvalues; characteristic equations; adjacency matrix.*

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OPTIMIZING INVENTORY IN TWO-WAREHOUSE WITH SHIFTING DEMAND PATTERNS FOR DETERIORATING ITEMS

Puneet Kumar, Abhinav Saxena, Kamesh Kumar

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University,

Moradabad (Uttar Pradesh), India.

Email: nirankari2608@gmail.com

Inventory management is crucial for the smooth operation of supply chains and businesses. This paper introduces a unique inventory model designed to address the complexities of managing inventory in dynamic environments characterized by exponential time-dependent demand and constant deterioration rates. The model focuses on a two-warehouse system, offering enhanced inventory control capabilities. In this setup, the secondary warehouse, which is rented, serves as a buffer to enhance inventory performances, while the primary warehouse, owned by the enterprise, remains the primary source of supplies. The overarching objective of this model is to optimize costs while meeting customer demand and maintaining satisfactory service levels. It seeks to achieve cost-effective inventory management by striking a balance between holding costs, ordering costs, and shortage costs. Additionally, the model's optimality has been demonstrated through rigorous analysis. This innovative approach to inventory management holds significant promise for improving efficiency and cost-effectiveness in supply chain operations.

Keywords- *Inventory management, exponential demand, inventory model, optimization.*

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OPTIMIZING WAREHOUSE SPACE ALLOCATION: A REVIEW AND APPLICATION OF LINEAR PROGRAMMING MODELS

Chhavi Gupta, Vipin Kumar, Kamesh Kumar

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University,

Moradabad (Uttar Pradesh), India.

Email: chhavi1official@gmail.com

Warehousing encompasses all tasks related to material handling within a supply chain's warehouse. These tasks often involve complex allocation decisions that can be optimized. This paper reviews recent literature proposing optimization models for warehouse space allocation, with the primary goal of comparing previous research and detailing warehouse space optimization using linear programming (LP). The LP model calculates daily pallet requirements based on daily demand and various constraints within a multi-product manufacturing environment, providing viable solutions that adhere to all constraints. This research is expected to serve as a reference for future studies in the field, offering a simple and efficient LP model for optimizing warehouse storage space through effective palletization.

Keywords: *Warehouse Management, Linear Programming Model, Optimization of Warehouse, Supply Chain Management.*

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OPTIMIZING INVENTORY MANAGEMENT FOR EXPONENTIAL DEMAND AND DETERIORATING ITEMS WITH TIERED DISCOUNT STRATEGIES

Khyati

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India

Email: contact2khyati@gmail.com

This paper presents an inventory model with structured discount policies depending on demand levels that is designed to manage deteriorating items in the face of exponential demand increase. Conventional inventory models deal with constant demand, but real-world situations frequently involve exponential demand increase, especially when new technology or market trends are involved. The intrinsic deterioration of things, which is significant in industries handling perishable commodities or delicate electronics, exacerbates this difficulty. Purchasing, holding, deterioration, and shortage costs are all included in the overall inventory costs that our model formulates as a non-linear optimisation problem. The incorporation of tiered discount levels 2%, 5%, and 10% triggered when demand declines, impacting inventory replenishment tactics, is a crucial component of our methodology. We show using analytical techniques and numerical simulations that using tiered discounts significantly lowers costs and improves inventory efficiency. A case study involving a retail electronics distributor validates the durability and practicality of our approach, demonstrating its major real-world relevance and offering strategic insights for inventory management under dynamic market situations. In addition to advancing inventory theory, this research gives managers a powerful tool for handling challenging inventory situations.

Keywords: *Inventory Management; Exponential Demand, Deterioration of Goods; Discount Strategies.*

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A METHOD TO MATHEMATICAL MODELING FOR GREEN SUPPLY CHAIN DESIGN THAT IS BASED ON AN OPTIMIZATION MODEL WITH MULTIPLE OBJECTIVES

Sarthak Goyal, Vipin Kumar

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India

Email: sarthakgoyal41441@gmail.com

Supply chain management (SCM) is facing new challenges due to the increasing industrialization of developed countries and globalization. The rapid increase in energy and material consumption rates has made sustainable development a pressing concern. New methods of SCM are needed to consider both economic and environmental factors when designing supply networks. This article presents a novel method for designing green supply chains (GSCs) that focuses on minimizing environmental harm from industrialization. The method uses a multi-objective optimization mathematical model and a closed loop network to minimize total costs and carbon dioxide emissions during supply chain setup. Three scalarization approaches weighted sum technique, weighted Tchebycheff, and augmented weighted Tchebycheff are used in the optimization process. The model's strengths and limitations are determined through computational findings. After testing in a case study, the model's fundamental weakness for real-size problems and its capacity to handle costs and environmental challenges is identified.

Keywords: *Multi-objective optimization, Tchebycheff*

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EOQ INVENTORY MODEL FOR LINEARLY INCREASING DEMAND AND NON-INSTANTANEOUS DETERIORATION WITH TWO-LEVEL TRADE CREDIT

[1]Khyati, [2]Ashendra Kumar Saxena

[1]*Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India*

[2]*College of Computing Science & IT, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India*

Email: contact2khyati@gmail.com

This work presents an Economic Order Quantity (EOQ) model designed for two-level trade credit arrangements with linearly growing demand and non-instantaneous item deterioration. The difficulties of modern inventory systems, which face dynamic demand patterns and progressive product decay, are beyond the capabilities of traditional EOQ models, which frequently assume constant demand and immediate item deterioration. Our model includes a demand rate that rises linearly in time as well as a deterioration rate that is based on time and inventory level in order to close this gap. It also takes into account the intricacies of two-level trade credit, which has a big impact on the operational and financial facets of inventory management. The model identifies the best ordering strategies by using differential equation-based optimisation to minimise the overall cost, which takes into account holding, ordering, and deterioration costs, while accounting for the subtleties brought about by trade credit. Sensitivity analysis show how these policies are impacted by changes in trade loan terms, degradation rates, and demand growth. A solid framework for optimising inventory decisions in a financially and operationally sound way is provided to managers in relevant sectors by the model, whose practical applicability is validated by numerical examples.

Keywords: *EOQ; increasing demand; non-instantaneous deterioration; trade credit; inventory management.*

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MATHEMATICAL MODELING OF METAMATERIAL PROPERTIES

Shivam kumar, Ajay Kumar Upadhaya

Department of Physics, Teerthanker Mahaveer University, Moradabad (U.P.) 244001, India

Email: shivamkumar14102001@gmail.com

Metamaterials are artificial materials designed to exhibit unique and often exotic properties not found in natural materials. These properties result from the careful design and arrangement of their microstructures, which can lead to phenomena such as negative refraction, near-zero permittivity or permeability, and high-resolution imaging. In this work, electromagnetic waves are studied in media with negative permeability and negative permittivity, called DNG media or DNG metamaterials and present a mathematical framework for computational modeling of metamaterial properties. Based on the principles of electromagnetic theory and Maxwell`s Equation we illustrate backward waves, negative phase velocity the application of these methods to the calculate various properties of metamaterials, such as effective permittivity and permeability, bandgap structure, and dispersion relations. For a theoretical view of DNG media, the domains of existence of TE and TM modes in metamaterials are also analysed. Finally, we analyse absorption, transmission and reflection of a metasurface which is designed by using CST (Computer Simulation Technology) Studio Suite. We conclude by highlighting the challenges and opportunities in mathematical modeling of metamaterials and the potential impact of this work on the design and optimization of metamaterial-based devices and applications.

Keywords: *Negative permeability, Negative permittivity, Negative refractive index, Backward wave, Maxwell`s Equation, Metasurface absorber*

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OPTIMIZING THE COST AND ROUTE OF TRANSPORTATION WITH LINEAR PROGRAMMING THROUGH PYTHON PROGRAMMING.

Avnish Yadav, Abhay Kumar, Bharat Pandey

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India

Email: abhay1911kumar@gmail.com

Operation Research has a great role in diverse fields one of them is Transportation Problem and the method involved in this is linear programming problem method. By using the python programming language, we have made a program on which after giving the authentic data regarding the demand and the supply of the products from warehouses to storehouses it gives us the most optimal path and the most optimal cost at which the product can be supplied to the storehouses and also tells us the from which route the number ofitem will be supplied to the particular storehouse will result in optimal cost.

Keywords: *Operation Research, Transportation Problem, linear programming problem, Python*

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FACTORS AFFECTING INFERTILITY ACROSS URBAN MILLENNIAL: A STRUCTURAL EQUATION MODELING BASED APPROACH

Stuti Gupta, Kamesh Kumar

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India

Email: stuti.gupta1712@gmail.com

The notion of 'triggered infertility' or self-made infertility is rather a new research concept and drawn tremendous research attention. There is ample research on natural infertility and clinical management yet focus on triggered infertility is missing. The research concentrates on the proximal and distal determinants in line with bioecological approach and underline the gravity of the problem as emerging. The proximal determinants often involve the individual as an agency himself as well as the environment in which skilling is being undertaken. The distal correlates identify as the distinct uncertainties that shape up the opinion making and perception development about state of triggered infertility. The research hence concludes the significant impact of millennia derived individual, vocational, career driven, health related, stress derived, contingent as well as sexual and reproductive malpractices; on triggering the state of infertility.

Keywords: *Triggered Infertility, Bioecological approach, Individual determinants, Proximal determinants, Distal determinants*

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ANALYZING 3D GRAPH PLOTTING AND REPRESENTATION TECHNIQUES USING MATLAB

Amisha Jain, Anchal Yadav, Aniket Gupta, Vipin Kumar

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad-244001, India

Email: amishajain1628@gmail.com

Three-dimensional (3D) graph plotting and visualization play a crucial role in various scientific, engineering, and mathematical domains. This abstract explores the techniques and methodologies involved in analyzing and representing 3D graphs using MATLAB, a widely used computational tool in academia and industry. The study delves into the fundamental principles underlying the creation of 3D graphs, including the mathematical models, algorithms, and visualization strategies employed. It investigates the functionalities and features provided by MATLAB for generating, customizing, and interpreting 3D plots, highlighting its versatility and efficiency in handling complex data structures. Furthermore, the abstract discusses the significance of accurate representation and interpretation of 3D graphs in research, simulation, and data analysis applications. The analysis encompasses various aspects such as surface plotting, mesh grid generation, contour plotting, and data interpolation techniques. Additionally, the abstract examines the challenges and limitations associated with 3D graph representation, including computational complexity, data visualization constraints, and interpretability issues. By comprehensively evaluating the capabilities and limitations of MATLAB in the context of 3D graph plotting and representation, this abstract provides valuable insights for researchers, practitioners, and educators seeking to leverage MATLAB for advanced data visualization and analysis tasks.

Keywords: *3D Graphs, Plotting of Graph, MATLAB*

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STUDY OF AIR QUALITY INDEX

Tanisha Gupta, Monika Ray, Maneesh Chauhan

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad-244001, India

Email: 9690taani@gmail.com

The Air Quality Index (AQI) is used for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects might be a concern for you. The AQI focuses on health affects you may experience within a few hours or days after breathing polluted air. Air quality Index is a tool for identify the present scenario of air quality. Six different methods of estimating Air quality Index (AQI) based on six pollutants synergistic effect viz., PM10, PM2.5, O3, NO2, SO2 and CO were used to compare the prevailing ambient air quality in the study region. By the use of Seasonal AQI calculation we conclude that air quality status in the study region under various classes ranging from good, moderate, satisfactory and unacceptable class for different AQI calculation.

Keywords: *Seasonal variation, Air pollutants, Air quality index*

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A STUDY ON THE APPLICATION OF HAMILTONIAN GRAPH

Manasvi Ruhela, Itika Verma, Amandeep singh, kamesh Kumar

Department of mathematics, Faculty of Engineerring, Teerthanker Mahaveer University, Moradabad

Email: itikaverma5@gmail.com

The Traveling Salesman Problem (TSP) is a well-known computational problem in the field of optimization and computer science. It involves finding the shortest possible route that visits a set of cities and returns to the origin city, visiting each city exactly once. In this project, we are showing the best shortest possible route by the Hamiltonian graph to the salesman to deliver all the parcels and covering each route exactly once. This problem has practical relevance in logistics, planning, and the routing of circuits.

Keywords: *Traveling Salesman Problem, Hamiltonian graph*

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INNOVATIVE METHOD FOR UTILIZING BELL WAVELET TO SOLVE DUAL FRACTIONAL INTEGRO DIFFERENTIAL EQUATION PROBLEMS

Pallavi Gupta, N. S. Chauhan

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India

Email: pallavimylife18@gmail.com

The Strategy that will be displayed, is numerical arrangement based on the Bell wavelet for solving Dual System of Fractional Integro Differential Equation.

First, we created an operational matrix of the Fractional Integro Differential Equation (FIDE). The application of this matrix changes to a frame work of algebraic conditions. Through this change, we can illuminate it by using a basic solution. Thus, the Bell wavelet and its operational matrix are the most important keys to our solution. Following our explanation of the methodology, we test the recommended approach in a few exemplary situations whose numerical results appear to be valid and useful. A high exactness is one of the best features of this procedure.

Keywords: *Algebraic Dual System, Bell wavelet, Fractional Calculas, Fractional Integro Differential Equation*

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A TECHNIQUE TO SOLVE COUPLED PARTIAL DIFFERENTIAL EQUATIONS THROUGH COUPLED MULTI-WAVELETS

Ramgopal Singh, N. S. Chauhan

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University,

Moradabad (Uttar Pradesh), India

Email: singhramss707@gmail.com

Coupled Partial differential equations (PDEs) play a crucial role in depicting the complex dynamics of numerous physical phenomena. Recently, Neural Operators have demonstrated their capacity to solve partial differential equations by acquiring the knowledge of the integral Kernel directly within Fourier/Wavelet Space. Thereby making the challenge of solving coupled partial differential equations (PDEs) depends on dealing with the coupled transformation between the functions. Towards the end, A coupled Multi-wavelets Neural Operator (CMWNO) learning scheme has purposed to solve coupled equations by decoupling the coupled integral kernels during the multi-wavelets decomposition and reconstruction procedures in the wavelet space. Towards this end, we present a wavelet-based technique to solve a coupled system of partial differential equations. The developed models achieve significantly higher accuracy compared to previous learning-based solvers in solving the coupled partial differential equations encompassing Gray-Scott (GS) equations the non- local field game (MFG) problem. As per our results, the proposed approach shows a 2*~ 4* improvement relative L_2 error compared to the optimal outcomes from the State-of-art data-driven models.

Keywords: *Neural Operators, Coupled Multiwavelets, Partial differential equations, Gray-Scott equations.*

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CASE STUDY ON GAME THEORY AND ITS APPLICATIONS IN DIPLOMATIC RELATIONS

Araish Khan, Prerna Saini

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India.

Email: khanaraish52@gmail.com

In this paper, I study Russia's 2022 invasion of Ukraine using game theory. I analyse different scenarios of the war based on three different realistic strategies that can be chosen by Russia, and three different realistic strategies that can be chosen by the West, leading to a simultaneous-move 3*3 non-cooperative game between these two players. In addition, I model both players with two different potential types: the West can be either approachable or aggressive, and Russia can be militant or insecure. While the available strategies of the players do not change, the type of a player determines the preferences over the available fixed strategies. Therefore, I model this situation as four different non-cooperative games depending on the player's types and solve all four games by finding their Nash equilibria.

In the second part of the paper, I include Ukraine as a third player who can affect the result of the war. The goal is to predict the possible future outcomes of the ongoing war and to gain a better insight into the world's future economic and political status.

Keywords: *Game theory, Diplomatic relations*

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DEVELOPING A MODEL FOR 2-PREDATOR-1-PREY USING LOTKA VOLTERRA MODEL

Divanshu Kumar, Vanshika Agrawal, Vaishnavi Sharma, Yash Kumar, Vijendra Singh Rawat

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University,

Moradabad (Uttar Pradesh), India

Email: divanshukumar077@gmail.com

Biomathematics which is also known as mathematical or theoretical biology, is a scientific research field that uses mathematical theory to answer the questions related to the biological systems. Mathematical ecology uses mathematical models to solve the problems in population dynamics, ecology, and evolution where ecology is the study of ecosystem i.e. the interaction of organisms with each other and with their environment.

In this research paper, we have worked on the mathematical modelling of prey and predators. In the earlier model of Lotka-Volterra, we had an ecosystem of one prey and one predator made with the help of some assumptions. In our model, we have continued with those same assumptions of the Lotka-Volterra model but the only difference we have made in the earlier ecosystem of one prey and one predator is that now we have introduced one more predator to the existing ecosystem i.e. now we have 2-predators and 1 prey in our ecosystem. Our analysis reveals that the addition of a second predator leads to a more complex behaviour. Our findings have implications for the understanding of ecosystems with multiple predator species and the potential consequences for population management and conservation.

Keywords: *Mathematical modelling, Lotka-Volterra model, Population management*

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EXPLORING THE THEORETICAL FOUNDATIONS, APPLICATIONS, AND RECENT ADVANCES IN ELECTRIC IMPEDANCE SPECTROSCOPY: A COMPREHENSIVE REVIEW

Prabhakar Sharma, Diptonil Banerjee*

Thin Film and Nanotechnology Laboratory, Faculty of Engineering and Computing Sciences, Teerthanker Mahaveer University, Moradabad, UP 244001, India

**Email: nilju82@gmail.com*

Electric Impedance Spectroscopy (EIS) is a powerful technique widely employed in various scientific disciplines, including physics, chemistry, biology, and engineering, for characterizing the electrical properties of materials and systems. This paper presents a comprehensive review of the theoretical underpinnings of EIS, focusing on its principles, applications, and recent advancements. The foundation of EIS lies in the analysis of how materials respond to alternating current (AC) excitation across a range of frequencies. By measuring the impedance, comprising resistance and reactance, at different frequencies, EIS provides valuable insights into the electrical behavior of complex systems. The theoretical framework of EIS encompasses various models, including equivalent circuit models, distributed parameter models, and statistical approaches, tailored to different experimental setups and material properties. This review elucidates the fundamental concepts underlying EIS, such as Ohm's Law, capacitive and inductive reactance, and the Nyquist and Bode plots, which are indispensable for interpreting impedance spectra. Furthermore, it discusses the significance of electrode polarization, interface effects, and electrode-electrolyte interactions, which influence impedance measurements in electrochemical systems. In addition to its fundamental principles, this paper explores the diverse applications of EIS across interdisciplinary fields. Examples include its use in biomedical diagnostics, where it aids in the characterization of biological tissues and detection of diseases, and its application in material science for assessing the properties of batteries, fuel cells, and corrosion protection coatings. Moreover, recent advancements in EIS techniques, such as frequency-domain and time-domain analyses, impedance tomography, and impedance-based biosensors, are highlighted, showcasing the continual evolution of this versatile methodology. In conclusion, this review underscores the importance of understanding the theoretical foundations of EIS for its effective application in diverse research areas. By elucidating the underlying principles and discussing recent developments, this paper aims to provide researchers with a comprehensive understanding of EIS, facilitating its utilization as a powerful tool for studying complex systems and advancing scientific knowledge.

Keywords: *Impedance, frequency, alternating current, dielectric constant*

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GRAPHITIC CARBON NITRIDE NANOSTRUCTURES FOR PHOTOCATALYTIC REMOVAL OF TEXTILE DYES

Karuna Chauhan[1], Diptonil Banerjee

Thin Film and Nanotechnology Laboratory, Faculty of Engineering,Teerthanker Mahaveer University, Moradabad, UP 244001, India

[1]Email: karunasinghchauhan@gmail.com

Graphitic carbon nitride (g-C_3N_4)-based photo catalysts have shown high efficiency for textile dyes removal. This study report that g-C_3N_4 nanostructure can be synthesized by low temperature hydrothermal process. As prepared sample g-C_3N_4 was characterized using X-ray diffraction (XRD), Energy Dispersive X- ray (EDX), scanning electron microscope (SEM), UV-Vis and Fourier transformed infrared (FTIR) spectroscopy. Thermal stability of the sample was analyzed with the help of thermal gravimetric and differential thermal analysis (TG-DTA) study. EDX confirms the elemental composition of sample whereas XRD result confirmed the proper phase formation. UV-Vis spectra helped calculation of the optical band gap of the material.

It has been shown that the as prepared g-C_3N_4 has high ability to remove poisonous textile dyes like Bengal rose through the photon assisted catalytic process under UV photon. It has been shown that the removal efficiency crosses 90 % within a time interval of 60 minutes which is believed to be due to prolong electron-hole pair separation under UV irradiation.

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ENHANCING ENERGY STORAGE WITH FUNCTIONALIZED CARBON NANOSTRUCTURES: A COMPREHENSIVE REVIEW

Mehak Parashar, Diptonil Banerjee*

Thin Film and Nanotechnology Laboratory, Faculty of Engineering and Computing Sciences, Teerthanker Mahaveer University, Moradabad, UP 244001, India

*Email: nilju82@gmail.com

Carbon-based nanostructures have emerged as promising materials for energy storage applications due to their exceptional properties such as high surface area, tunable porosity, and excellent electrical conductivity. This paper presents a comprehensive review of the recent advancements in utilizing functionalized carbon nanostructures for energy storage applications, with a focus on electrochemical energy storage systems. The research delves into various types of carbon nanostructures including carbon nanotubes (CNTs), graphene, carbon nanofibers (CNFs), and porous carbon materials, highlighting their unique characteristics and the methods employed for their functionalization. Functionalization strategies discussed encompass surface modification, doping with heteroatoms, and hybridization with other materials, aimed at enhancing specific energy storage properties such as capacitance in supercapacitors and energy density in batteries. Furthermore, the paper explores the utilization of functionalized carbon nanostructures in different energy storage devices, including lithium-ion batteries, supercapacitors, and hybrid capacitive-battery systems. The present study discusses the impact of functionalization on key performance metrics such as charge/discharge kinetics, cycling stability, and capacity retention, providing insights into the mechanisms governing improved energy storage performance. Moreover, the review highlights recent research trends and emerging applications of functionalized carbon nanostructures in energy storage, such as flexible and wearable energy storage devices, solid-state batteries, and integration into advanced electronic devices. In conclusion, the paper emphasizes the significant role of functionalized carbon nanostructures in advancing energy storage technologies. By elucidating the principles of functionalization and discussing recent developments, this review aims to provide researchers and practitioners with valuable insights into harnessing the potential of carbon nanostructures for efficient and sustainable energy storage solutions.

Keywords: *Energy storage, CNT, Functionalization, Supercapacitors, Specific capacitance*

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IMAGE ENCRYPTION AND DECRYPTION USING AFFINE-RSA CRYPTOSYSTEM

Kamal Kumar, Manoj Sharan

Department of Mathematics, Baba Mastnath University, Rohtak

Email: saharan19manoj@gmail.com

In this paper we proposed a technique to encrypt and decrypt a color image using Affine-RSA cryptosystem, the encrypted image pixels are again encrypted using RSA. We focus mainly on increasing the layers of encryption and hence increasing the complexity of decryption performed by attacker. Three different layers of encryption can protect original message more efficiently.

Keywords: *Image encryption, RAS, Color image.*

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APPLICATION OF EULERIAN TRAIL IN SPONGING SNOWY ROADS

Priyanshu Kumar, Khushi Chahal

School of Sciences, IFTM University, Lodhipur Rajput, Moradabad-244001 (UP) India

Email: pksingh4547@gmail.com

Eulerian trail is a trail in which every pair of adjacent vertices appear consecutively (i.e. every edge is used exactly once). Also eulerian graph is a connected graph containing eulerian circuit with every vertex having even degree.

In this paper, we have been working to make an innovative route plan for snow plough to clean all the streets of the given locality on a snowy day. We have deeply and immensely studied the hurdles of snowy city and have tried to make an optimal route such that the snow plough goes to every street once and cover all the streets in such a way that total travel distance is as short as possible.

The street network can be made like a connected graph with streets as edges and their intersections as vertices. Each edge has a weight which represent the actual length of the corresponding street. Under the primes, the snowplough is supposed to go in two different directions, hence it will be undirected. The main task now is to find a path in the graph such that the total edge weight is minimum. Through the above-mentioned method, we have come up with the shortest way covering all the streets in minimum rounds.

Keywords: *Graph, Eulerian trail, Eulerian Circuit.*

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EXPLORING FIXED POINT THEORY: APPLICATIONS AND EXTENSIONS

Sweeti Devi

Department of Mathematics, Baba Mastnath University, Rohtak, India

Email: swchahal92@gmail.com

Fixed point theory is a fundamental branch of mathematics with diverse applications in various fields, including economics, computer science, and physics. This paper provides an overview of key concepts and results in fixed point theory, ranging from classical theorems to recent developments. We explore applications of fixed point theory in areas such as optimization, game theory, and dynamical systems. Additionally, we discuss extensions of fixed point theory, including multi-valued and set-valued mappings, and their relevance in solving complex problems. Through this comprehensive review, we aim to highlight the significance and versatility of fixed point theory in modern mathematics and its interdisciplinary impact.

Fixed Point Theory is an integrative theory that provides discernment and significant tools for the solution of certain problems in several areas of interest in mathematics.

The existence and uniqueness of solutions for linear and nonlinear problems is commonly denoted as the fixed-point problems $Tx=x$, where T is self-operator in an abstract space X such as the existence and uniqueness of solutions to elliptic partial differential equations, and more recently the existence of answer sets in logic programming. The situation gets more complicated when self-operators are replaced with nonself-operators $T: A \rightarrow B$, where A and B are nonempty and disjoint subsets of X, it is clear that no fixed point will exist for nonself-operators. In this situation, the concept and importance of Approximate Fixed Point are highlighted.

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EXPLORING ENTROPY: FROM THERMODYNAMICS TO INFORMATION THEORY

Dr.Vinod Bhatia, Sweeti Devi

Department of Mathematics, Baba Mastnath University, Rohtak, India

Email: bhatiavinod88@gmail.com

This abstract provides an in-depth examination of the mathematical concept of entropy. Beginning with its origins in thermodynamics, it delves into its applications across various mathematical disciplines, including information theory, probability theory, and dynamical systems. The abstract discusses key theoretical frameworks, such as Shannon entropy and Kolmogorov-Sinai entropy, highlighting their significance in understanding randomness, disorder, and complexity in mathematical systems. Furthermore, it explores practical implications in data compression, cryptography, and statistical mechanics, demonstrating the wide-ranging impact of entropy in mathematics

Entropy is a concept that emerged in the 19th century. It used to be associated with heat harnessed by a thermal machine to perform work during the Industrial Revolution. However, there was an unprecedented scientific revolution in the 20th century due to one of its most essential innovations, i.e., the information theory, which also encompasses the concept of entropy. Therefore, the following question is naturally raised: "what is the difference, if any, between concepts of entropy in each field of knowledge?" There are misconceptions, as there have been multiple attempts to conciliate the entropy of thermodynamics with that of information theory. Entropy is most commonly defined as "disorder", although it is not a good analogy since "order" is a subjective human concept, and "disorder" cannot always be obtained from entropy. Therefore, this paper presents a historical background on the evolution of the term "entropy", and provides mathematical evidence and logical arguments regarding its interconnection in various scientific areas, with the objective of providing a theoretical review and reference material for a broad audience.

Keywords: *Entropy, Thermodynamics, Information Theory, Probability*

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A SHORT SURVEY OF EQUIANGULAR TIGHT FRAMES

[1]Virender, [2]Nikita Dalal and [3]Kamal Kumar

[1]*Department of Mathematics, Shyam Lal College, University of Delhi, Delhi 110032 (INDIA)*
[2,3]*Department of Mathematics, Baba Mastnath University, Rohtak 124001 (INDIA)*

[1]*Email: virender57@yahoo.com*

Frames are generalization of bases in Hilbert and Banach spaces. These are building blocks for the space and are able to reconstruct every element of the space, just like bases. Due to vast applications and emerging new applications of the theory of frames, different types of frames with various advantages are being introduced recently. Equiangular tight frames are one such types of frames which are used in many geometric and physical applications. In the present short survey, equiangular tight frames are discussed. A brief historical overview together some important results is provided in the paper.

Keywords: *Hilbert spaces, Inner product, Frames, Equiangular Frames, Stability, Perturbation.*

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MULTI-OBJECTIVE MULI-CRITERIA EVOLUTIONARY ALGORITHM FOR MULTI-OBJECTIVE MULTI-TASK OPTIMIZATION

Rashmi Shridher, Dr. Vipin Kumar

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University (U.P.) India 244001.

Email: rashmishridher512@gmail.com

Evolutionary multi-objective multi-task optimization is an emerging pattern for solving multi-objective multi-task optimization problem (MO-MTOP) using evolutionary computation. However, There are many methods to treat the multiple multi- objective tasks as different problems and optimize them by different populations, which face the difficulty in designing good knowledge transferring strategy among the tasks. This paper proposes to treat the MO-MTOP as a multi objective multi-criteria optimization problem (MO-MCOP), so that the knowledge of all the tasks can be inherited in a same population to be fully utilized for solving the MO-MTOP more efficiently. the fitness evalution function of each task in the MO-MTOP is treated as an evalution criterion in the corresponding MO-MCOP, and therefore, the MO-MCOP has multiple relevant evalution criteria to help the individual selection and evolution in different evolutionary stages. Furthermore, a probability based selection strategy and an adaptive learning method are also proposed to better select the fitness evalution function as the criterion. By doing so, the algorithm can use suitable evalution criteria from different tasks at different evolutionary stages to guide the individual selection and population evolution, so as to find out the Pareto optimal solutions of all tasks. By integrating the above, this paper develops a multiobjective multi-criteria evolutionary algorithm framework for solving MO-MTOP. To investigate the proposed algorithm, extensive experiments are conducted on widely used MO-MTOPs to compare with some state-of-the-art and well performing algorithms, which have verified effective and efficiency of the proposed algorithm. Therefore, treating MO-MTOP as MO-MCOP is a potential and promising direction for solving MO-MTOP.

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SYNTHESIZE AND CHARACTERIZATION NANOCOMPOSITE BLEND POLYMER ELECTROLYTE

Kailash Kumar, Amit Kumar Sharma

Department of Physics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad 244001

Email: kailashkumaryadav524@gmail.com

Using the solution cast approach, which involved blending Polyvinyl alcohol (PVA)/Chitosan (CS) blend polymers in different ratios and dispersing CuO nanoparticles inside the polymer matrix, copper oxide (CuO) nanofillers were mixed with blend polymers to create nanocomposite polymer films. Potassium iodide (KI) salt was added, which allowed ions to move more easily through the electrolyte system. CuO is fully distributed throughout the blend polymer of PVA/CS, according to SEM research, and this smooth surface backdrop reflects the amorphous nature of PVA. Additionally, scanning electron microscopy (SEM), impedance spectroscopy, Fourier-transform infrared spectroscopy (FTIR), and X-ray diffraction (XRD) were used to assess the optical and electrical properties of the produced electrolytes.

Keyword: PVA/CS with CuO nanofillers, Optical and Electrical properties, Salt, Blend polymer.

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TWO-DIMENSIONAL MODEL IN THE PRESENCE OF LEAK, PUMP AND CHANNEL TO STUDY THE CALCIUM DIFFUSION IN CIRCULAR CROSS SECTION HEPATOCYTES CELL

Vijendra Singh Rawat, Ashok Kumar

Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University (U.P.) India 244001.

Email: Vijendr.rawat@gmail.com

Intracellular free calcium (Ca^{2+}) signaling in hepatocytes cell has been studied wildly through modeling and experiments both. Calcium plays an essential role in signal transduction in hepatocyte cell. Of particular interest are the changes in Ca^{2+} concentration in the cytosol and endoplasmic reticulum (ER) and the dynamics of localized Ca^{2+} elevations due to Ca^{2+} release from clusters of Ca^{2+}-regulated ion channels, Pump and leak. This paper develops a two-dimensional mathematical model to study independence of all the important parameters like influx over calcium profile, diffusion coefficient. Model also incorporates the ER fluxes like; J*leak, J Pump and J Chan*. Finite Element method is applying to solve this problem for numerical results. Here a computer program is developed for find numerical results through graph by using MATLAB 2010b run on Core (TM) i3 CPU 2328 @ 2.20 GHz processing speed and 4 GB RAM.

Keyword: *Reaction Diffusion, calcium profile, ER flux, FEM, Hepatocytes*

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THE INFLUENCE OF VARIATION OF GA CONTENT ON STRUCTURAL PROPERTIES OF AMORPHOUS CHALCOGENIDE Ge26-xGaxTe74 SYSTEM.

Manuj Kumar Agarwal

Moradabad Institute of Technology, Moradabad

Email: manuj6july@gmail.com

Researchers have toned their interest towards the amorphous Chalcogenide glasses as they are the promising materials for optoelectronics applications since last decade. The ternary Ge-Ga-Te system has been used to prepare the thin film. During the study it was found that the values of "Tg" decreases with increasing "Ga". Content which shows to chemically ordered network version of the system. The impact on the physical characteristic viz. mean bond energy per atom ⟨Ecl⟩, the average bond energy per atom ⟨Erm⟩, the average coordination number ⟨Z⟩, the average heat of atomization "Hs"" were studied with the variation in Gallium content for Ge26-xGaxSe74 [4<x< 20] system. All the parameter goes on decreasing and favour to the formation of glasses.

Keywords: *Glasstrasition transition temperaure, Mean bond energy, Average coordination no., Heat of atomization.*

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OVERVIEW OF QUEUING MODELS TO PREDICT CONGESTION AND CROWDING IN TRANSPORTATION NETWORK

[1]Reema Saxena, [2]Ashendra Kumar Saxena

[1]*Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India*

[2]*College of Computing Science & IT, Teerthanker Mahaveer University, Moradabad (Uttar Pradesh), India*

[1]*Email: reemasaxena2@gmail.com*

Queuing models are mathematical tools used to analyse waiting lines or queues in various systems, including transportation networks. These models help predict congestion and crowding by examining the behaviour of queues under different conditions. In transportation networks, congestion and crowding can lead to delays, reduced efficiency, and increased costs. Therefore, understanding and predicting these phenomena are crucial for effective network management and planning. By applying queuing models to transportation networks, planners and operators can identify potential bottlenecks, optimize resource allocation, and develop strategies to mitigate congestion and crowding. The basic components of a queuing model include arrivals, service times, and the number of service channels or servers. In summary, By simulating the behavior of queues under different scenarios, these models enable stakeholders to make informed decisions and improve the overall efficiency and reliability of transportation systems.

Keywords: *Queuing Models, Transportation Network, Congestion.*

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A STUDY OF EMERGING COVID-19 VARIANTS AND THEIR IMPACT, ASSOCIATION, EFFICIENCY AND DIAGNOSIS BY STATISTICAL TOOLS IN INDIA

Ashok kumar [1] , Shiv kumar [2]

Department of Statistics, Janta Vedic College, Baraut (Baghpat) Ch. Charan Singh University, Meerut -250005, India.

[1]*Email: ashoksiddhu111@gmail.com*

The purpose of this research paper the Emergence of novel and evolving of various variants of SARS-COV-2 has the need for change in the form of newer and more adaptive diagnostic methods for the detection of SARS-COV-2 infections as well as we obtain the association and efficiency of various variants apply the statistical tools. Here we are developing rapid and sensitive diagnostic technologies more challenging due to emerging variants and varying symptoms we prepare a list of association, efficiency of various variants in India. Data were entered through the survey and visit from Government and Private hospitals using an adapted SPSS version software package. In this review, we provide an updated perspective on the current challenges by the enable their detection. In addition, we also discuss the development, formulation, working mechanisms, advantages and drawbacks of the most used vaccines/ drugs and their subsequent immunological Impact in India.

Keywords: *COVID-19, SARS-COV-2,Omicron, Diagnostic testing*

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ADDRESSING UNCERTAINTY IN MULTI-OBJECTIVE TRANSPORTATION PROBLEMS: A COMPREHENSIVE REVIEW

Khilendra Singh [1], Sachin Kumar Agrawal [2], Navneet Rohela [3]

Department of Applied Sciences & Humanities, Moradabad Institute of Technology, Moradabad, Uttar Pradesh, India, Pin-244001

Email: ksdhariwal82@gmail.com

Transportation systems play a critical role in modern societies, facilitating the movement of people and goods efficiently. However, uncertainties inherent in transportation operations pose significant challenges to decision-makers, necessitating the integration of uncertainty management techniques into transportation planning and optimization processes. The Multi-Objective Transportation Problem (MOTP) arises in scenarios where multiple conflicting objectives, such as minimizing costs, reducing emissions, and improving service quality, need to be simultaneously optimized. A thorough analysis of the most recent techniques and strategies for handling uncertainty in MOTPs is presented in this work. First, we provide an overview of the fundamental concepts of MOTPs and the sources of uncertainty in transportation systems, including demand fluctuations, travel time variations, and unpredictable disruptions. Next, we discuss the various modeling techniques employed to represent uncertainty, ranging from stochastic programming and robust optimization to fuzzy logic and interval analysis. Furthermore, we examine the integration of uncertainty into multi-objective optimization frameworks, emphasizing the importance of considering multiple conflicting objectives while accounting for uncertainty. We explore heuristic and metaheuristic algorithms, such as genetic algorithms, simulated annealing, and particle swarm optimization, which have been adapted to handle uncertainty in MOTPs effectively.

Keywords: *Optimization, Uncertainty, Multi-Objective Transportation Problem (MOTP), Decision-making.*

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UNDERSTANDING RENEGING PHENOMENA IN QUEUING THEORY: A COMPREHENSIVE ANALYSIS

Sachin Kumar Agrawal[1], Khilendra Singh[2], Navneet Rohela[3]

Department of Applied Sciences & Humanities, Moradabad Institute of Technology, Moradabad, Uttar Pradesh, India, Pin-244001

[1]*Email: sachin269mit@gmail.com*

Queuing theory serves as a fundamental framework for analyzing and optimizing the performance of various systems characterized by the arrival of entities and their subsequent service. Reneging, a phenomenon where customers abandon the queue before receiving service, has garnered significant attention due to its implications on system efficiency and customer satisfaction. This paper presents a comprehensive analysis of reneging phenomena within the context of queuing theory. We discuss the underlying factors contributing to reneging behavior, including customer impatience, perceived waiting time, and service quality. We also discuss the distinction between patient and impatient customers and the impact of reneging on system performance metrics such as average waiting time, queue length, and service utilization. Moreover, we deal with strategies for mitigating reneging effects and enhancing queuing system performance. These strategies include optimizing staffing levels, implementing priority mechanisms, and redesigning service processes to reduce perceived waiting time and customer dissatisfaction. This analysis provides valuable insights into the understanding and management of reneging phenomena in queuing theory, offering guidance for practitioners and researchers seeking to optimize the performance and customer experience of queuing systems across various domains.

Keywords: *Reneging, Waiting time, Queue length, Service utilization, Queuing theory.*

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A LITERATURE REVIEW ON TRANSPORTATION SYSTEM: TRAFFIC SIGNAL MANAGEMENT

Parambrata Sanyal[1], Gopal Kumar Gupta[2]

Symbiosis Institute of Technology Nagpur, Symbiosis International (Deemed) University, Pune, India

[1]Email: sparambrata26@gmail.com

The recurring issue of traffic congestion has turned out to be a problem of concern in different cities around the world. With rapid urbanization, there is also a rapid increase in the number of vehicles leading to the serious threat of traffic congestion. Now, the traditional traffic system is visibly unable to handle this transport scenario. A traffic controlling system with optimized traffic flow and minimized congestion can only reduce the overall wastage of country's economy, pollution, significantly in terms of optimised travel time in any transport system. Since last two decades the Intelligent transport system (ITS) appears to be the only way that provides us a coordinated way of using transport networks. This paper reviews the various existing models and their limitations in traffic control system given by the different researchers till date in terms of the Intelligent transport system (ITS) to solve this pervasive issue. At the end of the review we have identified the leading models and their solution approach. Also we concluded the work that needs to be done in the future for providing a more effective, accurate and credible way for users to use Intelligent transport system (ITS).

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A LITERATURE REVIEW ON TWO QUEUE PROBLEM

Gopal Kumar Gupta

Symbiosis Institute of Technology Nagpur, Symbiosis International (Deemed) University, Pune, India

Email: gopalkumar.gupta@sitnagpur.siu.edu.in

The Two queue problem turned out to be a problem of concern in different areas of real world problem which leads to traffic congestion in of the queuing system. A traffic controlling system with optimized traffic flow and minimized congestion can only reduce the overall wastage of country's economy, pollution, significantly in terms of optimised travel time in any transport system. Since last two decades the two-queueing system appears to be a thrust area in queuing problems. This paper reviews the various existing models and their limitations in two queuing system. At the end of the review we have identified the leading models and their solution approach.

Keywords: *Literature review, Queue problem, Queue theory*

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GENERALIZED R-NORM MEASURE FOR FUZZY INFORMATION

Chinu Goyal[1], Alisha Aggarwal[2]

[1]*Khalsa College for Women, Civil lines, Ludhiana, Punjab*
[2]*A. S College for Women, Khanna, Punjab*

Email: [1]*goyalchinu1986@gmail.com* , [2]*aggarwalalisha95@gmail.com*

In various situations of life, when we are in a fix about the selection of most suitable alternative among various alternatives, hesitant fuzzy set theory plays a vital role. Several extensions and generalizations of fuzzy sets have been introduced in the literature, for example, Atanassov's intuitionistic fuzzy sets, type 2 fuzzy sets, and fuzzy multisets. In this paper, we proposed a new fuzzy entropy measure in the setting of hesitant fuzzy set (HFS) theory dealing with the subject of R-norm information measure. The proposed measure satisfies the priori definition of HFSs and also inspects its properties. Compared to already present entropy measures in literary work, various instances are given to illustrate the effectiveness of R- norm information measure. One of the most critical factors that influences a decision-making process is attribute weights. It aims to provide a clear understanding of its application and its tendencies.

Keywords: *R-norm information measure, Entropy, Hesitant fuzzy set, Prospect theory, Multi-attribute decision-making.*

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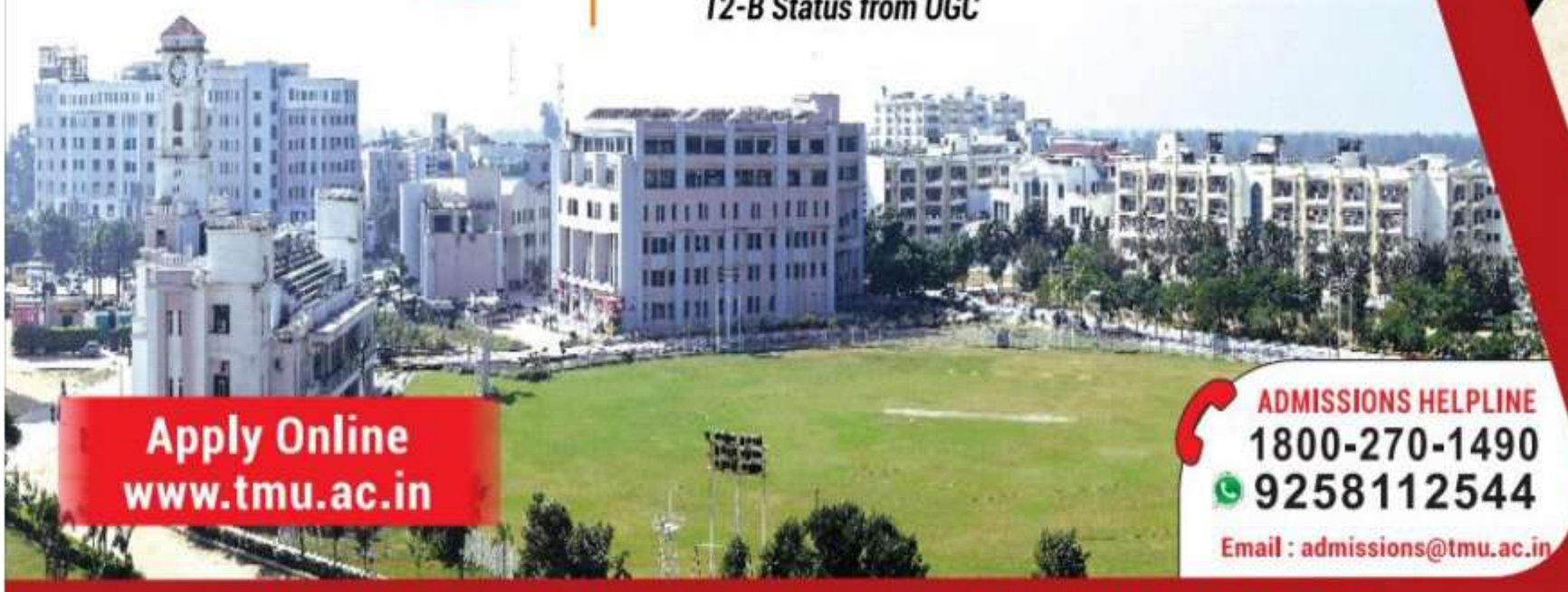

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