

# Hafiz M. Khalid Mahmood

HEC Approved PhD  
Supervisor



## Professional Biography

**Dr. Hafiz Muhammad Khalid Mahmood** has been a permanent faculty member in the Department of Mathematics at the University of Punjab in Lahore, Pakistan since 2001. He began his formal teaching career in 1999 and has worked with prestigious institutions such as Hajvery University and the University of Central Punjab. With nearly 26 years of teaching experience, he has established himself as an accomplished educator in his field.

Dr. Khalid's academic journey is marked by numerous prestigious achievements, including a [silver medal and a national talent scholarship from the Lahore Board](#), a [gold medal from Government College Sheikhpura](#), the [President UGC scholarship with a second national rank](#), and [securing second position in his M.Phil.](#) He began his career at the University of the Punjab as a lecturer and was awarded [seven advanced increments based on his performance](#) in interviews (4), academic accomplishments (2), and orientation (1).

Throughout his career, Dr. Khalid [has taught over 20 courses at the B.S., M.Sc., M.Phil., and Ph.D. levels](#), earning immense respect from his students. His research expertise spans Number Theory, Group Theory, Combinatorics, and Mathematical Modeling, incorporating Statistical Distributions and Fuzzy Logic. He earned his Ph.D. in Number Theory from the University of the Punjab, where his research focused on graph structures derived from number theory and their combinatorial properties. His doctoral studies were jointly supervised by the late Prof. Dr. Khalid Latif Mir and Prof. Dr. Farooq Ahmad.

Dr. Khalid [has published over 65 articles in renowned international journals](#), collaborating with leading foreign researchers and serving as a reviewer for various journals. He has [supervised 7 Ph.D. scholars, 20 M.Phil. scholars, and 2 M.Sc. projects](#), and is currently mentoring one Ph.D. scholar and four M.Phil. scholars.

Beyond academics, Dr. Khalid is passionate about sports and excels in cricket, badminton, and swimming. His ultimate aim is to promote peace and deliver quality education to uplift society and the nation. Dedicated to supporting his students in both teaching and research, he is always available to guide them whenever needed.

## Personal Details

Present Status	Associate Professor (Mathematics)		
Degrees	B.Sc., M.Sc., M.Phil., PhD (Mathematics)	Gender	Male
Postal Address	Department of Mathematics, University of the Punjab, Lahore-54590 Pakistan	Citizenship	Pakistan
Contact	Mob +92-300-4343119 Off +92-42-99231241 Ext: 114 Fax +92-42-99230329	Email	khalid.math@pu.edu.pk drhafizkm@gmail.com
YouTube Lectures	<a href="https://www.youtube.com/@dr.khalidmahmood9756">https://www.youtube.com/@dr.khalidmahmood9756</a>	Home Page	<a href="http://pu.edu.pk/faculty/description/421/Dr-Muhammad-Khalid-Mahmood.html">http://pu.edu.pk/faculty/description/421/Dr-Muhammad-Khalid-Mahmood.html</a>
Researchgate	<a href="https://www.researchgate.net/profile/Muhammad-Mahmood-5/">https://www.researchgate.net/profile/Muhammad-Mahmood-5/</a>	Google Scholar	<a href="https://scholar.google.com/citations?user=WZ8No6IAAAAJ&amp;hl=en">https://scholar.google.com/citations?user=WZ8No6IAAAAJ&amp;hl=en</a>
ORCID	<a href="http://orcid.org/0000-0002-1071-2808">http://orcid.org/0000-0002-1071-2808</a>		

## Education

### Academic

2009-2014 **Ph.D.**, *University of the Punjab*, Lahore, Pakistan.  
**Course Work-** CGPA 3.77 Graph Theory, Group Theory, Linear Groups and Group Representations, Rings and Modules, Integral Equations, Elastodynamics  
**Title of the Thesis:** Structures of Discrete Graphs and Modular Arithmetic  
**Supervisors:** Prof. Dr. K. L. Mir (x-Chairman, Department of Mathematics, Punjab University, Lahore) and Dr. F. Ahmad (Associate Professor, Combinatorics, Comsats University, Lahore)

- 2007-2009 **M.Phil., CGPA 3.76, [University of the Punjab](#)**, Islamabad, Pakistan.  
**Courses:** Field Extension and Galois Theory, Spectral Theory in Hilbert Spaces, Functional Analysis, Numerical Methods, Partial Differential Equations, Theory of Spline Functions, Riemannian Geometry, General Relativity  
**Title of the Thesis:** Classifications of the Elements of  $Q^*\sqrt{n}$  via Congruences and the Modular Group  $PSL(2, Z)$   
 (worked out the homothety equations for spherically symmetric space-times admitting maximal isometry groups larger than  $SO(3)$  along with their metrics without imposing any restrictions on the stress energy tensor.)  
**Supervisor:** Dr. M. A. Malik (Associate Professor, Punjab University, Lahore)
- 1994-1996 **M.Sc., 1st division, [University of the Punjab](#)**, Lahore, Pakistan.  
**Courses:** Real Analysis, Group Theory and abstract Algebra, Complex Analysis, Vector and Mechanics, Topology and Functional Analysis, Advance Analysis, Mathematical Physics, Numerical Analysis, Number Theory, Operation Research, Mathematical Statistics
- 1991-1993 **B.Sc., 1st division, [Government Degree College](#)**, Sheikhupura, Pakistan.  
**Courses:** Mathematics A and B Courses and Statistics
- 1989-1991 **F.Sc., 1st division, [Government Degree College](#)**, Sheikhupura, Pakistan.  
**Courses:** Mathematics and Statistics
- 1987-1989 **Martriculation 1st division, [Government Higher Secondary School](#)**, Farooq Abad, Pakistan.  
**Courses:** Science Subjects
- 2006 **Certificate of GAT-General Test, [Higher Education Commission](#)**, Islamabad, Pakistan.  
**Courses:** GRE-General
- 2013 **Certificate of GAT-Subject Test, [Higher Education Commission](#)**, Islamabad, Pakistan.  
**Courses:** Mathematics
- 2013 **Certificate of GRE-Subject Test, [ETS \(Educational Testing Service\)](#)**, International, America.  
**Courses:** Mathematics
- 1986 **Certificate of Hafize-Quraan**, Farooq Abad, Pakistan.  
**Courses:** Quraan
- 1992 **Certificate of NCC (National Cadit Course), [Government Degree College](#)**, Sheikhupura, Pakistan.  
**Courses:** Cadit

## Computer Skills

- CAS Work comfortably with the Computer Algebra System (CAS), **Mathematica** for numeric, symbolic and graphics programming and familiar with **Matlab** as well.
- $\LaTeX$  Work comfortably with  $\LaTeX$  type setting
- MS Office Microsoft Office suite (Word, Excel and Power Point)
- MathType Work comfortably with Equation Editor for  $\TeX$   $\LaTeX$  and MathML documents

## Computer Courses Attended

- 1999-2000 Attended Courses of C++, Data Structures and Computer Applications, Department of Computer Science, University of Central Punjab (PICS), Lahore, Pakistan.

## Awards and Honors

- 1985-1987 **Hafiz-e-Qur'an, [Jamia Jishtia, Farooq Abad](#)**, Sheikhupura, Pakistan.
- 1991-1992 **Silver Medal, [Lahore Board of Intermediate and Secondary Education](#)**, Lahore, Pakistan.
- 1991-1992 **National Talent Scholarship, [Lahore Board of Intermediate and Secondary Education](#)**, Lahore, Pakistan.
- 1993-1994 **Gold Medal, [Govt. Degree College](#)**, Sheikhupura, Pakistan.
- 1994-1996 **Second Position Among all Universities in President, Talent Forming Scheme Scholarship at M.Sc. Level, [Universities Grant Commission \(UGC\)](#)**, Islamabad, Pakistan.
- 2001 **Advance Increments, [Performance based four advance increments in the interview for the post Lecturer](#)**, University of the Punjab, Lahore, Pakistan.
- 2007-2009 **First Position in M. Phil Admission Test, [University of the Punjab](#)**, Lahore, Pakistan.

- 2007-2009 **Second Position in M. Phil from Department of Mathematics, University of the Punjab, Lahore, Pakistan.**
- 2009-2014 **First Position in PhD Admission Test, University of the Punjab, Lahore, Pakistan.**
- 2011 **Advance Increments, performance based two advance increments in the interview for the post of Assistant Professor, University of the Punjab, Lahore, Pakistan.**
- 2012, 2014 **Earned Research Incentive Award, University of the Punjab, Lahore, Pakistan.**
- 2017-2021 **Earned Research Incentive Award, University of the Punjab, Lahore, Pakistan.**
- 2012-2021 **Earned Performance Evaluation Award, University of the Punjab, Lahore, Pakistan.**
- 2020 **Advance Increments, performance based one advance increments in the interview for the post of Associate Professor, University of the Punjab, Lahore, Pakistan.**

## Experience

### Teaching and Work

#### Faculty Member

2020- to-date **Associate Professor of Mathematics, University of the Punjab, Lahore, Pakistan.**

##### Courses Taught:

##### PhD/MPhil/MS:

- Linear Groups and Group Representations, ◦ Advance Number Theory, ◦ Field Extensions and Galois Theory, ◦ Rings and Modules

##### M.Sc/BS (4 year programs)/B.Sc. Hons. (3 year programs):

- Real Analysis-I, ◦ Real Analysis-II, ◦ Number Theory-1, ◦ Number Theory-II, ◦ Group Theory-1, ◦ Group Theory-II, ◦ Group Theory-III, ◦ Mathematical Statistics-I, ◦ Mathematical Statistics-II, ◦ Calculus-I, ◦ Calculus-II, ◦ Multivariable Calculus, ◦ Complex Analysis-I, ◦ Topology, ◦ Discrete Mathematics

2011-2020 **Assistant Professor of Mathematics, University of the Punjab, Lahore, Pakistan.**

##### Courses Taught:

##### PhD/MPhil/MS:

- Linear Groups and Group Representations, ◦ Advance Number Theory, ◦ Field Extensions and Galois Theory

##### M.Sc/BS (4 year programs)/

- Real Analysis-I, ◦ Real Analysis-II, ◦ Number Theory-1, ◦ Number Theory-II, ◦ Group Theory-1, ◦ Group Theory-II, ◦ Group Theory-III, ◦ Mathematical Statistics-I, ◦ Mathematical Statistics-II, ◦ Calculus-I, ◦ Calculus-II, ◦ Multivariable Calculus, ◦ Rings and Modules, ◦ Topology, ◦ Discrete Mathematics, ◦ Linear Algebra

2001- 2011 **Lecturer of Mathematics, University of the Punjab, Lahore, Pakistan.**

##### Courses Taught:

##### MS Hons.:

- Representation Theory, ◦ Rings and Modules

##### M.Sc/BS (4 year programs)/:

- Real Analysis-I, ◦ Real Analysis-II, ◦ Number Theory-1, ◦ Number Theory-II, ◦ Group Theory-1, ◦ Group Theory-II, ◦ Group Theory-III, ◦ Mathematical Statistics-I, ◦ Mathematical Statistics-II, ◦ Calculus-I, ◦ Calculus-II, ◦ Multivariable Calculus, ◦ Complex Analysis-I, ◦ Vector Analysis, ◦ Numerical Analysis-I, ◦ Numerical Analysis-II, ◦ Operation Research-I, ◦ Operation Research-II, ◦ Ordinary and Partial Differential Equations, ◦ Rings and Modules, ◦ Topology, ◦ Functional Analysis, ◦ Discrete Mathematics, ◦ Linear Algebra

1999- 2001 **Lecturer of Mathematics, University of Central Punjab Punjab (UCP), Lahore, Pakistan.**

##### Courses Taught:

##### MCS:

- Discrete Mathematics, ◦ Probability and Distributions

##### MBA/BBA:

- Business Mathematics, ◦ Business Statistics and Probability

##### BSCS (4 year programs)/:

- Calculus-I, ◦ Calculus-II, ◦ Multivariable Calculus, ◦ Numerical Analysis, ◦ Ordinary Differential Equations, ◦ Discrete Mathematics, ◦ Linear Algebra

1998- 1999 **Lecturer of Mathematics**, *Hajvery University*, Lahore, Pakistan.

**Courses Taught:**

**MCS:**

◦ Discrete Mathematics, ◦ Probability and Distributions

**BSCS (4 year programs)/:**

◦ Calculus-I, ◦ Calculus-II, ◦ Multivariable Calculus, ◦ Numerical Analysis

1997- 1998 **Lecturer of Mathematics**, *Muslim Post Graduate College (MPGC)*, Lahore, Pakistan.

**Courses Taught: M.Sc:**

◦ Real Analysis, ◦ Number Theory, ◦ Group Theory, ◦ Mathematical Statistics, ◦ Numerical Analysis, ◦ Operation Research, ◦ Topology, ◦ Functional Analysis, ◦ Linear Algebra

#### Visiting Faculty

2020- 2022 **Visiting Faculty Member**, *Institute of Education and Research, University of the Punjab, Lahore, Pakistan*, Lahore, Pakistan.

**Courses Taught:**

**BSED-Scienc Mathematics** ◦ Real Analysis, ◦ Funtional Analysis, ◦

**BED-Islamic Education Mathematics General**

2018-2020 **Visiting Faculty Member**, *Department of Physics, University of the Punjab*, Lahore, Pakistan.

**Courses Taught:**

**BS Hons.** ◦ Discrete Mathematics

2008-2011 **Visiting Faculty Member**, *National University of Computer and Emerging Sciences (NUCES-FAST)*, Lahore, Pakistan.

**Courses Taught:**

**BSCS** ◦ Calculus-I, ◦ Calculus-II, ◦ Multivariable Calculus, ◦ Linear Algebra, ◦ Discrete Mathematics

2006-2008 **Visiting Faculty Member**, *University of Management and Technology*, Lahore, Pakistan.

**Courses Taught:**

**BS Hons.** ◦ Calculus, ◦ Linear Algebra, ◦ Discrete Mathematical

2004-2006 **Visiting Faculty Member**, *Institute of Business Administration (IBA), University of the Punjab*, Lahore, Pakistan.

**Courses Taught:**

**MBA/BBA Business Mathematics and Statistics**

2001-2003 **Visiting Faculty Member**, *Punjab Institute of Computer Science (PICS)*, Lahore, Pakistan.

**Courses Taught:**

**BCS/MCS** ◦ Calculus-I, ◦ Calculus-II, ◦ Calculus-III, ◦ Linear Algebra, ◦ Discrete Mathematics, ◦ Ordinary Differential Equations, ◦ Business Mathematics and Statistics, ◦ Probability and Distributions, ◦ Numerical Methods

2002-2003 **Visiting Faculty Member**, *Punjab College of Business Administration (PCBA)*, Lahore, Pakistan.

**Courses Taught:**

**BBA/MBA Business Mathematics and Statistics**

2002-2004 **Visiting Faculty Member**, *Punjab University College of Information Technology (PUCIT)*, Lahore, Pakistan.

**Courses Taught:**

**MCS Operation Research**

2002-2005 **Visiting Faculty Member**, *Department of Space Science, University of the Punjab*, Lahore, Pakistan.

**Courses Taught:**

**BS. Hons.** ◦ Calculus-I, ◦ Calculus-II

2001-2002 **Visiting Faculty Member**, *Institute of Chemistry, University of the Punjab*, Lahore, Pakistan.

**Courses Taught:**

**BS. Hons. Mathematics**

2001-2002 **Visiting Faculty Member**, *Department of Bio-Chemistry, University of the Punjab*, Lahore, Pakistan.

**Courses Taught:**

**BS. Hons.** ◦ General Mathematics

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## Research Introduction

- **Group Theory and Number Theory with Graph Theory-** Graphs and groups are excellent examples of abstractions. While their origins can often be traced back to real-world phenomena for example, networks in graph theory or symmetries in physical systems for group theory their research goes far beyond these applications. These structures provide frameworks for understanding and organising mathematical concepts in a variety of fields, including geometry, algebra, computer science, and physics. Similarly, graphs can be used to visualise modular arithmetic, a key topic in number theory. Certain graph constructions can reveal patterns in prime factorization relationships between numbers. Furthermore, concepts like Euler's totient function, sigma function, primitive roots, and quadratic reciprocity laws can be employed to visualize the results graphically, providing a geometric perspective on arithmetic phenomena. Indeed, graphs, like group theory and number theory, connect concrete applications to abstract reasoning, making them invaluable tools for investigating mathematical concepts.
- **Mathematical Modeling-** Mathematical modelling is a powerful tool for understanding, simulating, and optimizing complex systems in a variety of fields. In recent years, its applications have grown significantly to include image processing, pattern recognition, proteomics, and fuzzy logic, providing novel solutions to complex problems. These interdisciplinary approaches address data analysis, prediction, and decision-making challenges by combining mathematical frameworks and computational techniques. In image processing, mathematical models are critical for tasks such as image enhancement, segmentation, and feature extraction. They enable the accurate representation and transformation of visual data, which is essential for applications such as medical imaging, remote sensing, and computer vision. Pattern recognition, on the other hand, employs mathematical algorithms to detect patterns and structures in data. Mathematical models make speech recognition, biometrics, and natural language processing easier by utilizing techniques such as statistical analysis, machine learning, and neural networks. In proteomics, mathematical modelling is critical for analyzing complex protein networks and interactions. It allows researchers to simulate biological systems, predict protein functions, and identify biomarkers, accelerating progress in personalized medicine and drug development. Finally, fuzzy logic provides a flexible approach to reasoning and decision-making in systems marked by uncertainty and vagueness. Mathematical models, which combine fuzzy sets and logic-based rules, provide reliable solutions for controlling systems, optimizing processes, and making predictions in fields as diverse as artificial intelligence, robotics, and economics.

**Research Interests** Number Theory, Group Theory, Discrete Mathematics, Combinatorics and Mathematical Modeling

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## Research Background

### M.Phil. Work

My M.Phil. work is little abstract. To abstract something is to remove its specific context or application, thereby isolating the essence of its structure or behaviour. Abstraction is important in mathematics because it enables us to identify and study patterns, symmetries, and relationships in a universal way. Modern mathematics thrives on this principle, attempting to connect seemingly disparate areas by focussing on their shared structural properties. In my M.Phil. work, I have enumerated the number of closed paths under the action of the modular group  $PSL(2, Z)$  over an invariant set  $Q^* \sqrt{n}$ . I have proposed and proved a closed form formulas for the enumeration of orbits under the action of the modular group  $PSL(2, Z)$ .

**Ph.D. Work** In number theory, graphs appear in unexpected and elegant ways. For example, the study of integers and their divisors can be represented by graphs, in which vertices represent numbers and edges represent relationships such as divisibility. Similarly, modular arithmetic, a central topic in number theory can be visualised using groups, which encode group structure and provide insight into how numbers behave under modular constraints. For example, certain graph constructions can reveal patterns in prime distribution or relationships between co-prime numbers. Furthermore, concepts such as Euler's totient function and quadratic residues can be graphically explored, providing a geometric perspective on arithmetic phenomena. This interplay between the discrete world of numbers and the combinatorial world of graphs creates new avenues for discovery, highlighting mathematics' profound unity. Through this lens, graph theory is more than just a tool for modelling relationships; it is also a bridge that connects various mathematical concepts.

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## Research Supervision

### Ph.D.

- 2023- todate Mr. Awais Raza  
**Provisional Research Area: Number Theory (Covering of Integers)** (current project)  
University of the Punjab, Lahore, Pakistan
- 2021- todate Mr. Abrar Ahmad  
**Extensions of Complex Fuzzy Graphs** (writeup in progress)  
University of the Punjab, Lahore, Pakistan
- 2021- todate Ms. Aneela  
**Classification of Modular and Algebraic Based Structured Graphs with Their Spectral Characteristics (Project Completed)**  
University of the Punjab, Lahore, Pakistan
- 2021- 2024 Mr. Muhammad Sufyan Asif  
**Structures and Applications of New Families of Graphs Based on Set of Moduli (Project Completed)**  
University of the Punjab, Lahore, Pakistan
- 2021- 2024 Mr. Asif Abd-ur Rehman  
**Novel Characterizations of Structured Graphs with Their Spectral Characteristics with Their Metrics and Topological Indices (Project Completed)**  
University of the Punjab, Lahore, Pakistan
- 2018-to 2021 Mr. Shahbaz Ali  
**New Classes of Integers and Their Applications in Graphs (Project Completed)**  
University of the Punjab, Lahore, Pakistan
- 2018- 2021 Ms. Asma Ehsan  
**A Computationally Efficient Mathematical Model for the Pattern Analysis in Proteomics (Project Completed)**  
University of the Punjab, Lahore, Pakistan
- 2016- 2021 Mr. Muhammad Haris Mateen  
**A structural study of digraphs over finite rings using modular exponentiation (Project Completed)**  
University of the Punjab, Lahore, Pakistan

### M. Phil.

- 2024-2025 todate Mr. Muhammad Hamza  
**Structure of Graphs via Product of Groups** (work in progress)  
University of the Punjab, Lahore, Pakistan
- 2024-2025 todate Mr. Muhammad Awais  
**New Classes of Integers with Applications in Graph Labeling** (work in progress)  
University of the Punjab, Lahore, Pakistan
- 2024-2025 todate Ms. Aysha  
**Quadratic Graphs of Congruences on a Set of Moduli** (work in progress)  
University of the Punjab, Lahore, Pakistan

- 2024-2025 todate Ms. Shameela  
**Cubic Graphs of Congruences on a Set of Moduli** (work in progress)  
 University of the Punjab, Lahore, Pakistan
- 2023-2024 Mr. Shakir Mahmood  
**Degree Based Entropies and Polynomial Analysis of Molecular Descriptors in Four Pharmaceutical Compounds (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2023- 2024 Mr. Muhamad Abyaz  
**Modified Dombi Aggregation Operators and Their Applications** (work in progress)  
 University of the Punjab, Lahore, Pakistan
- 2023-2024 Mr. Muhammad Sajawal Ali  
**Development and Application of Degree Based Topological Indices for Crofelemer in Botanical Drug System (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2022-2023 Mr. Abid Ali  
**Construction of Lie Groups with Topological Properties and Representations (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2022-2023 Mr. Muhammad Awais Raza  
**Development and Application of Vertex-Distance Based Topological Indices for Various Benzenoid Systems (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2022-2023 Mr. Assad-ur-ehman  
**Development and Application of Hybrid QSAR/QSPR Models: A Prediction for Physical Properties of Chemicals via Q Distance-Topological Indices, and Modified Indices (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2021-2022 Ms. Sidra Yousaf  
**Probabilistic Modeling and Factor Graphs with Applications (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2019-2020 Mr. Muhammad Asif Abu-ur-ehman  
**Digraphs over Number Theoretic Multiplicative Functions (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2019-2020 Mr. Muhammad Ghulfam  
**New Aggregation Operators for Multi-Criteria Decision Making (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2019-2020 Ms. Tayyaba  
**Structures of Digraphs Defined Over Lambert-Type Maps (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2018-2019 Mr. Syfyan Asif  
**New Families of Congruences over Regular Partition and Regular Bipartitions of Integers**  
 University of the Punjab, Lahore, Pakistan
- 2018-2019 Ms. Aneela  
**Applications of q-ochhammer Symbol and New Modular Investigations for Regular Partition of Integers by Aneela (Completed)**  
 University of Sargodha, Lahore Campus, Lahore, Pakistan
- 2018-2019 Mr. Muhammad Abrar  
**Identification of Acetylalanine Sites by Incorporating Mathematical Modeling and Statistical Moments into Chou's PseAAC (Completed)**  
 University of Sargodha, Lahore Campus, Lahore, Pakistan
- 2016-2017 Mr. Shahbaz Ali  
**New Numbers on Euler's Totient Numbers With Applications (Completed)**  
 University of the Punjab, Lahore, Pakistan

- 2016-2017 Ms. Asma Ehsan  
**Applications of Mathematical Modelling for the Position and Composition based Features Proteomics (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2014-2015 Ms. Lubna Anwar  
**Structures of Digraphs Arising from Discrete Lambert Mappings (Completed)**  
 University of the Punjab, Lahore, Pakistan

## B.Sc. Hons.

- 2008-2009 Mr. Farooq Ahmad and Mr. Hafiz Muteurahman  
**Wonders of Numbers (Completed)**  
 University of the Punjab, Lahore, Pakistan
- 2006-2007 Ms. Farkhanda Afzal and Ms. Maryam  
**Modular Arithmetic (Completed)**  
 University of the Punjab, Lahore, Pakistan

## List of Publications

### Published Work

- [1] Sufyan Asif and M. Khalid Mahmood. *A Useful Encryption of Discrete Graphs on Symmetric Groups*. Journal of Information and Optimization Sciences (to appear) 2025, 1-20.  
<https://www.tandfonline.com/journals/tios20>.  
 Accepted: Jan 29, 2025 (WOS-ESCI).
- [2] Asif Abdur Rehman and M. Khalid Mahmood. *Structures and Metric Dimensions of Divisor Euler Function Graph  $G(D(\phi(t)))$* . Advances and Applications in Discrete Mathematics (to appear) 2025, 1-18.  
<https://www.pphmj.com/journals/aadm.htm>.  
 Accepted: December 26, 2024 (WOS-ESCI).
- [3] Sufyan Asif and M. Khalid Mahmood. *Structural properties of the graphs arising from congruences over set of moduli*. JP Journal of Algebra, Number Theory and Applications, 64 (1) 2025, 81-98.  
<https://doi.org/10.17654/0972555525005>.  
 Published Online: December 14, 2024 (WOS-ESCI).
- [4] Shahbaz Ali, M. Khalid Mahmood and Sobia Ghaffar. *Several topological indices and entropies for certain families of commutative graphs over Quaternion groups*. VFAST Transactions on Mathematics, 12(2) 2024, 32-38.  
<https://doi.org/10.21015/vtm.v12i2.1901>.  
 Published: Sep 30, 2024 (HEC Recognized Y-Category).
- [5] Sufyan Asif, M. Khalid Mahmood, Amal S. Alali and Abdullah A. Zaagan. *Structures and Applications of Graphs Arising from Congruences over Moduli*. Aims Mathematics, 9 (8) 2024, 21786-21798.  
<https://doi.org/10.3934/math.20241059>.  
 Published: July 09, 2024 (WOS-SCIE, Impact Factor: 1.8).
- [6] Aneela, M. Khalid Mahmood, and Daud Ahmad. *Order structured graphs of cyclic groups and their classification*. VFAST Transactions on Mathematics, 12(1) 2024, 220-233.  
<https://doi.org/10.21015/vtm.v12i1.1756>.  
 Published: May 14, 2024 (HEC Recognized Y-Category).
- [7] Shahbaz Ali, Raúl M. Falcón and M. Khalid Mahmood. *Local fractional metric dimension of rotationally symmetric planar graphs arisen from planar chorded cycles*. Rendiconti di Matematica e delle Sue Applicazioni, 44 (3) 2023, 159-179.  
<https://doi.org/10.48550/arXiv.2105.07808>.  
 Published: Feb 07, 2024 - Impact Factor: 4.6
- [8] Shahbaz Ali, M. Khalid Mahmood and M.S. Hameed. *Some new generalized modular relations*. TWMS J. App. and Eng. Math, 13(2) 2023, 425-439.  
<http://jaem.isikun.edu.tr/web/index.php/archive/119-vol13no2/978>.  
 Published: April 01, 2023 - Impact Factor: 2.9
- [9] Muhammad Awais Raza, M. Khalid Mahmood, Muhammad Imran, Fairouz Tchier, Daud Ahmad, and Muham-



mad Kashif Masood. Computational studies on diverse characterizations of molecular descriptors for graphyne nanoribbon structures. *Molecules*, 28(18), Sep 2023.

<https://doi.org/10.3390/molecules28186597>.

Published: September 13, 2023 - Impact Factor: 4.2

- [10] Shahbaz Ali, M. Khalid Mahmood and K.P Shum. *On Characterization of Quadratic Exponential Invertible Graphs*. *Southeast Asian Bulletin of Mathematics*, 47 (6) 2023, 733-741.  
<https://www.seams-bull-math.ynu.edu.cn/archive.html>.  
Published: December 10, 2023 - Impact Factor: 2.6
- [11] Asif Abdurehman and M. Khalid Mahmood. *Properties of graphs based on divisor-Euler function*. *Scientific Inquiry and Review*. 7(4) 2023, 54-66.  
<https://doi.org/10.32350/sir.74.04>.  
Published: October 26, 2023 - Impact Factor: 6.2
- [12] Daud Ahmad, M. Khalid Mahmood, Qin Xin, Ferdous M. O. Tawfiq, Sadia Bashir, and Arsha Khalid. *A computational model for q-Bernstein Quasi-minimal Bézier surface*. *Journal of Mathematics*, 2022:8994112, Sep 2022.  
<https://doi.org/10.1155/2022/8994112>  
Published: September 20, 2022 - Impact Factor: 1.29
- [13] M. Khalid Mahmood, and Lubna Anwar. *The Iteration Digraphs of Lambert Map Over the Local Ring  $\mathbb{Z}/p^k\mathbb{Z}$ : Structures and Enumerations*. *Iranian Journal of Mathematical Sciences and Informatics*, 17(2) (2022), 307-314.  
<http://ijmsi.ir/article-1-1499-en.html>  
September 05, 2022 - Impact Factor 0.643
- [14] Jia-Bao Liu, Shahbaz Ali, M. Khalid Mahmood and M. Haris Mateen. *On m-polar Diophantine Fuzzy N-soft set with Applications*. *Combinatorial Chemistry and High Throughput Screening*, 25 (3) (2022), 536-546. IF: 1.195  
[1+.0.2174/1386207323666201230092354](https://doi.org/10.2174/1386207323666201230092354)  
March 01, 2022 - Impact Factor 1.195
- [15] Yaser Daanial Khan, M. Khalid Mahmood, Daud Ahmad, and Nasser M. Al-Zidi. *Content-based image retrieval using gamma distribution and mixture model*. *Journal of Function Spaces*, 2022:8674038, 2022.  
<https://doi.org/10.1155/2022/8674038>  
Published: May 05, 2022 - Impact Factor: 1.807
- [16] M. Khalid Mahmood and Daud Ahmad. *An elucidation of palm print recognition techniques using probabilistic and computational paradigms*. *VFAST Transactions on Software Engineering*, 10(1):30-38, January-March 2022.  
<http://dx.doi.org/10.21015/vtse.v10i1.926>  
Published: March 07, 2022- Y-category journal
- [17] M. Haris Mateen, M. Khalid Mahmood, Daud Ahmad, Shahbaz Ali, and Shajib Ali. *A paradigmatic approach to find equal sum partitions of zero-divisors via complete graphs*. *Journal of Chemistry*, 2022:1587689.  
<https://www.hindawi.com/journals/jchem/2022/1587689/>  
doi: <https://doi.org/10.1155/2022/1587689>  
Published: March 29, 2022- Impact Factor: 2.506
- [18] M. Haris Mateen, M. Khalid Mahmood, Shahbaz Ali and M.D Ashraful Alam. *On Symmetry of Complete Graphs over Quadratic and Cubic Residues*. *Journal of Chemistry*, (1) 2021, 1-9. Article ID 4473673.  
<https://doi.org/10.1155/2021/4473637>  
December 08, 2021 - Impact Factor 3.0
- [19] M. Haris Mateen, M. Khalid Mahmood, Duha A Kattan and Shahbaz Ali. *A novel approach to find partitions of  $Z_m$  with equal sum subsets via complete graphs*. *AIMS Mathematics*, 6(9) (2021), 9998-10024.  
[doi:10.3934/math.2021581](https://doi.org/10.3934/math.2021581)  
July 06, 2021 - Impact Factor 0.643
- [20] M. Haris Mateen, M. Khalid Mahmood, Dilshad Alghazzawi, Jia-Bao Liu. *Structures of power digraphs over the congruence equation  $x^9 \equiv y \pmod{m}$  and enumeration*. *AIMS Mathematics*, 6(5) (2021), 4581-4596.  
[10.3934/math.2021270](https://doi.org/10.3934/math.2021270)  
Feb 22, 2021 - Impact Factor 0.643
- [21] Shahbaz Ali, M. Khalid Mahmood and Kar Ping Shum. *Novel Classes of Integers and Their Applications in Graph Labeling*. *Haceteppe Journal of Mathematics and Statistics*, 50(4) (2021), 1094-1110.  
[10.15672/hujms.825723](https://doi.org/10.15672/hujms.825723)  
August 06, 2021 - Impact Factor 0.643
- [22] Shahbaz Ali and M. Khalid Mahmood. *A Paradigmatic Approach to Investigate Restricted Totient Graphs and*

- their Indices*. International Journal of Mathematics and Computer Science, 16(2) (2021), 793-801.  
<https://future-in-tech.net/Volume16.2.htm>  
 Jan 25, 2021 - Impact Factor 0.643
- [23] Shahbaz Ali, M. Khalid Mahmood and Raúl M. Falcón. *A paradigmatic approach to investigate restricted hyper totient graphs*. AIMS Mathematics, 6(4) (2021), 3761-3771.  
<https://doi:10.3934/math.2021223>  
 Jan 26, 2021 - Impact Factor 0.643
- [24] Shahbaz Ali, M. Khalid Mahmood, Fairouz Tchier and F.M.O. Tawfiq, Classification of Upper Bound Sequences of Local Fractional Metric Dimension of Rotationally-Symmetric Hexagonal Planar Networks. Journal of Mathematics, (1) (2021), 1-24. Article ID 6613033.  
<https://doi.org/10.1155/2021/6613033>  
 Feb 28, 2021 - Impact Factor 0.643
- [25] H. Alolaiyan, M. Haris Mateen, D. Pamucar, M. Khalid Mahmmod, and F. Arslan, *A Certain Structure of Bipolar Fuzzy Subrings*. Symmetry, 13 (8) (2021), 1397-1417.  
<https://doi.org/10.3390/sym13081397>  
 August 01, 2021 - Impact Factor 0.643
- [26] Maji, Ghorai, M. Khalid Mahmood, and M. Alam. *On the Inverse Problem for Some Topological Indices*. Journal of Mathematics (1) 2021, 1-8. Article ID 9411696.  
<https://doi.org/10.1155/2021/9411696>  
 November 30, 2021 - Impact Factor 0.643
- [27] Mamoona Farooq, Asif Abd ul Rehman, M. Khalid Mahmood, and Daud Ahmad. Upper bound sequences of rotationally symmetric triangular prism constructed as halin graph using local fractional metric dimension. VFAST Transactions on Mathematics, 9(1), January-December, 2021.  
<http://dx.doi.org/10.21015/vtm.v9i1.1020>
- [28] Daud Ahmad, Saba Naeem, Abdul Haseeb, and M.Khalid Mahmood. A computational approach to a quasi-minimal Bézier surface for computer graphics. VFAST Transactions on Software Engineering, 9(4):150-159, October-December, 2021.  
<http://dx.doi.org/10.21015/vtse.v9i4.929>
- [29] Shouzhen Zeng, Shahbaz Ali, M. Khalid Mahmood, Florentin Smarandache and Daud Ahmad. *Decision-Making Problems under the Environment of m-Polar Diophantine Neutrosophic N-Soft Set*. CMES-Computer Modeling in Engineering and Sciences, 130(1):581-606, 2022.  
 Published in special issue: Advances in Neutrosophic and Plithogenic Sets for Engineering and Sciences: Theory, Models, and Applications (ANPSESTMA)  
<https://www.techscience.com/CMES/online/detail/18268>  
 doi: 10.32604/cmcs.2022.017397  
 Published Online: September 07, 2021, Published: January 01, 2022. Impact Factor: 1.593
- [30] Kottakkaran Sooppy Nisar, Javaid Ali, M. Khalid Mahmood, Daud Ahmad, and Shahbaz Ali. Hybrid evolutionary pad approximation approach for numerical treatment of nonlinear partial differential equations. Alexandria Engineering Journal, 60(5):4411-4421, 2021.  
<https://www.sciencedirect.com/science/article/pii/S111001682100185X?via%3Dihub>  
 March 31, 2021 - Impact Factor 3.732
- [31] Daud Ahmad, Kanwal Hassan, M. Khalid Mahmood, Javaid Ali, Ilyas Khan, and M. Fayz-Al-Asad. Variationally improved Bézier surfaces with shifted knots. Advances in Mathematical Physics, 2021(5):14, 2021.  
<https://www.hindawi.com/journals/amp/2021/9978633/>  
 August 25, 2021 - Impact Factor 1.128
- [32] M. Khalid Mahmood, and Lubna Anwar. *The Iteration Digraphs of Lambert Map Over the Local Ring  $\mathbb{Z}/p^k\mathbb{Z}$ : Structures and Enumerations*. Iranian Journal of Mathematical Sciences and Informatics, 17(2) (2022) 307-314.  
<http://ijmsi.ir/article-1-1499-en.html>  
 September 05, 2022 - Impact Factor 0.643
- [33] Aneela, M. Khalid Mahmood, Daud Ahmad, and Shahbaz Ali. More modular arithmetic in five regular partitions by Jacobi triple product formula. VFAST Transactions on Mathematics, 7(1), January-December 2019.  
<https://vfast.org/journals/index.php/VTM/article/view/426/891>  
 Published: December 31, 2019- - Y-category journal
- [34] M. Gulfam, M. Khalid Mahmood. *New Dombi Aggregation Operators on Bipolar Neutrosophic Set with Application in Multi-attribute Decision-making Problems*. Journal of Intelligent and Fuzzy System, 40(3) (2021), 5043-5060.

<http://dx.doi.org/10.3233/JIFS-201762>

March 05, 2021 - Impact Factor 1.851

- [35] M. Khalid Mahmood, Zeng S, Gulfam M, Shahbaz Ali, Jin Y. *Bipolar neutrosophic dombi aggregation operators with application in multi-attribute decision making problems*. IEEE Access, 26(8) (2020) 156600-14.  
<http://dx.doi.org/10.1109/ACCESS.2020.3019485>  
Published: August 26, 2020 - Impact Factor 3.745.
- [36] M. Khalid Mahmood, A. Ehsan, Y.D Khan, and Chou, K.C. *iHyd-LysSite (EPSV): Identifying Hydroxylysine Sites in Protein Using Statistical Formulation by Extracting Enhanced Position and Sequence Variant Feature Technique*. Current Genomics, 21(7) (2020) 536-45.  
<http://dx.doi.org/10.2174/1389202921999200831142629>  
Published: November, 2020 - Impact Factor 2.630.
- [37] M. Haris Mateen, and M. Khalid Mahmood. *A new approach for the enumerations of components of digraphs over quadratic maps*. Journal of Prime Research in Mathematics, 16(2) (2020) 56-66.  
Published: December 09, 2020 -  
HEC Recognized Y-Category.
- [38] M. Khalid Mahmood and Shahbaz Ali. *NEW NUMBERS ON EULER'S TOTIENT FUNCTION WITH APPLICATIONS*. Journal of Mathematical Extensions, 14(1) (2020) 61-83.  
<https://www.ijmex.com/index.php/ijmex/article/view/975/434>  
Published: April 10, 2020 - (WOS-ESCI)
- [39] Shahbaz Ali, M. Khalid Mahmood and M. Haris Mateen. *New Labeling Algorithm on Various Classes of Graphs with Applications*. International Conference on Innovative Computing (ICIC), IEEE processing (2019).  
<https://ieeexplore.ieee.org/document/8966729>  
Published: Jan 23, 2020
- [40] M. Haris Mateen, M. Khalid Mahmood and Shahbaz Ali. *Importance of Power Digraph in Computer Science*. International Conference on Innovative Computing (ICIC), IEEE processing (2019).  
<https://ieeexplore.ieee.org/document/8966737>  
Published: Jan 23, 2020
- [41] Aneela and M. Khalid Mahmood. *A New Relation in Q-Pochhammer Symbol With Applications*. VFAST Transactions on Computer Sciences, 15(3) (2018) 46-51.  
<https://vfast.org/journals/index.php/VTCS/article/view/533/584>  
Published: December 31, 2019 - HEC Recognized Y-Category.
- [42] M. Haris Mateen and M. Khalid Mahmood. *Power Digraphs Associated with the Congruence  $x^n \cong y \pmod{m}$* . Punjab University journal of Mathematics, 51(5) (2019) 93-102.  
[https://pu.edu.pk/images/journal/maths/PDF/Paper-7\\_51\\_5\\_2019.pdf](https://pu.edu.pk/images/journal/maths/PDF/Paper-7_51_5_2019.pdf)  
Published: March 25, 2018 - WOS-ECI.
- [43] Asma Ehsan, Muhammad K Mahmood, Yaser D Khan, Omar M Barukab, Sher A Khan, Kuo-Chen Chou. *iHyd-PseAAC (EPSV): Identifying Hydroxylation Sites in Proteins by Extracting Enhanced Position and Sequence Variant Feature via Chou's 5- Step Rule and General Pseudo Amino Acid Composition*. Current Genomics, 20 (2) (2019) 124-133.  
<https://pubmed.ncbi.nlm.nih.gov/31555063/>  
Published: Feb, 2019 - Impact Factor: 2.172.
- [44] M. Khalid Mahmood and Shahbaz Ali. *On super totient numbers, with applications and algorithms to graph labelling*. Ars Combinatorica, 143 (1) (2019) 29-38.  
<http://www.combinatoire.ca/ArsCombinatoria/Voll143.html>  
Published: January, 2019 - Impact Factor 0.192.
- [45] Asma Ehsan, Khalid Mahmood, Yaser Daanial Khan, Sher Afzal Khan and Kuo-Chen Chou. *A Novel Modeling in Mathematical Biology for classification of Signal Peptide*. Scientific Reports Nature, (8) (2018) 1-16.  
<http://dx.doi.org/10.1109/ACCESS.2020.3019485>  
Published: Jan 18, 2018 - Impact Factor 4.011.
- [46] Y. D Khan and M. Khalid Mahmood. *Posture Recognition and Imitation using Haar Wavelet Transform and Neural Networks*. Journal of Intelligent Computing, 9(4) (2018) 133-143.  
<http://dx.doi.org/10.6025/jic/2018/9/4/133-143>.  
Published: December 01, 2018 - HEC Recognized X-Category..
- [47] Aneela and M. Khalid Mahmood. *Novel Investigations in Q-Pochhammer Symbol*. VFAST Transactions on Computer Sciences, 6(14) (2018) 98-103.

<https://vfast.org/journals/index.php/VTCS/article/view/534/583>

Published: December 22, 2018 - HEC Recognized Y-Category..

- [48] S. Mahmood, Y.D Khan and M. Khalid Mahmood. *A treatise to vision enhancement and color fusion techniques in night vision devices*. *Multimed Tools Appl*, 77 (2018) 2689-2737.  
<https://link.springer.com/article/10.1007/s11042-017-4365-y>  
Published: Feb 13, 2017 - Impact Factor 2.101.
- [49] M. Khalid Mahmood and Farooq Ahmad. *An Informal Enumeration of Squares of  $2^k$  using Rooted Trees Arising from Congruences*. *Utilitas Mathematica*, 105 (2017) 41-51.  
<http://utilitasmathematica.com/index.php/Index/article/view/1162>  
Published: Sep 11, 2017 - Impact Factor 0.228.
- [50] S. Saeed, M. Khalid Mahmood and Y.D Khan. *An exposition of facial expression recognition techniques*. *Neural Computing and Applications*, 29 (2018) 425-443.  
<http://dx.doi.org/10.1007/s00521-016-2522-2>  
Published: August 29, 2016 - Impact Factor 4.664.
- [51] M. Khalid Mahmood and Y.D Khan. *A Generalized Classification and Enumeration of Obits of  $Q^*(\sqrt{n})$  by  $PSL(2, Z)$* . *U.P.B. Sci. Bull., Series A*, 78(3) (2016) 53-60.  
[https://www.scientificbulletin.upb.ro/rev\\_docs\\_arhiva/full12f0\\_257879.pdf](https://www.scientificbulletin.upb.ro/rev_docs_arhiva/full12f0_257879.pdf)  
Published: August 05, 2016 - Impact Factor 0.279.
- [52] M. Khalid Mahmood and Shahbaz Ali. *A Novel Labeling Algorithm on Several Classes of Graphs*. *Punjab University Journal of mathematics*, 49(2) (2017) 23-35.  
[https://pu.edu.pk/home/journal/pujm/V49\\_2\\_2017.html](https://pu.edu.pk/home/journal/pujm/V49_2_2017.html)  
Published: May 24, 2017 - (WOS-ESCI).
- [53] M. Khalid Mahmood and Lubna Anwar. *Loops in Digraphs of Lambert Mapping Modulo Prime Powers: Enumerations and Applications*. *Advances in Pure Mathematics*, 6(8) (2016) 564-570.  
<http://dx.doi.org/10.4236/apm.2016.68045>  
Published: August 26, 2020 - HEC Recognized Y-Category.
- [54] A. H. Butt, M. Khalid Mahmood and Yaser Daanial Khan., *An Exposition Analysis of Facial Expression Recognition Techniques*. *Pakistan Journal of Science*, 68(3) (2016) 357-365.  
<https://nja.pastic.gov.pk/PJS/index.php/PJS/article/view/1074/1068>  
Published: September 10, 2016 - HEC Recognized Y-Category.
- [55] M. Jamil, M. Khalid Mahmood and Yaser Daanial Khan. *An Appraisal of Automated Hand Gesture Recognition Techniques*. *Pakistan Journal of Science*, 68(4) (2016) 432-440 .  
<https://nja.pastic.gov.pk/PJS/index.php/PJS/article/view/1113/1107>  
Published: December 12, 2016 - HEC Recognized Y-Category.
- [56] M. Khalid Mahmood and Farooq Ahmad. *Recursive Elucidation of Polynomial Congruences Using Root-Finding Numerical Techniques*. *Abstract and Applied Analysis*, 5151 (2014) 1-9.  
<https://doi.org/10.1155/2014/575064>  
Published: Feb 27, 2015 - Impact Factor 1.274.
- [57] M. Khalid Mahmood and Y.D Khan. *A Novel Technique for the Elucidation of Linear and Quadratic Congruences*. *Pakistan Journal of Science*, 67(3) (2015) 264-268.  
<https://nja.pastic.gov.pk/PJS/index.php/PJS/article/view/837/831>  
Published: August 15, 2015 - HEC Recognized X-Category.
- [58] M. Khalid Mahmood and Y.D Khan. *An Appraisal Algorithm for Tests of Divisibility Using Modular Arithmetic*. *Pakistan Journal of Science*, 67(4) (2015) 365-370.  
<https://nja.pastic.gov.pk/PJS/index.php/PJS/article/view/888/882>  
Published: December 29, 2015 - HEC Recognized X-Category.
- [59] M. Khalid Mahmood and Farooq Ahmad. *A Classification of Cyclic Nodes and Enumerations of Components of a Class of Discrete Graphs*. *Appl. Math. Inf. Sci*, 9(1) (2015) 103-112.  
<https://www.naturalspublishing.com/files/published/647sm5pj756454.pdf>  
Published: Jan 01, 2015 - Impact Factor 1.21.
- [60] Yaser Daanial Khan, Nabeel Sabir Khan, Shoaib Farooq, Adnan Abid, Sher Afzal Khan, Farooq Ahmad, M Khalid Mahmood. *An Efficient Algorithm for Recognition of Human Actions*. *Scientific World Journal*, 875879 (2014) 1-11.  
<http://dx.doi.org/10.1109/ACCESS.2020.3019485>  
Published: August 27, 2014 - Impact Factor 1.219.

- [61] M. Aslam Malik and M. Khalid Mahmood. *On Simple Graphs Arising from Exponential Congruences*. Journal of Applied Mathematics, 292895 (2012) 1-10.  
<http://dx.doi.org/10.1109/ACCESS.2020.3019485>  
 Published: October 11, 2012 - Impact Factor 0.834.
- [62] M. Khalid Mahmood and M. A Malik. *An Account of Congruences Mod  $pk$  Using Halley's Method*. World Applied Sciences Journal, 16 (11) (2012) 1626-1630.  
[https://www.idosi.org/wasj/wasj16\(11\)12/18.pdf](https://www.idosi.org/wasj/wasj16(11)12/18.pdf)  
 Published: July 16, 2012 - HEC Recognized X-Category.
- [63] M. A. Malik and M. Khalid Mahmood. Some Invariant Subsets of  $Q^*(\sqrt{n})$  under the action of the Modular Group  $PSL(2, Z)$ . International Mathematical Forum, 6(32) (2011) 1557-1565.  
<https://www.m-hikari.com/imf-2011/29-32-2011/>  
 Published: Feb 26, 2011 -

## Submitted Work

- [64] Aneela, M. Khalid Mahmood and Daud Ahmad. *Symmetry of Algebraic Structured Simple Graphs: Characterizations and Applications, 2024*.
- [65] Aneela, M. Khalid Mahmood and Daud Ahmad. *Symmetry of Algebraic Structured Graphs Constructed on Subgroups, 2024*.
- [66] Sufyan Asif and M. Khalid Mahmood. *A Useful Encryption of Discrete Graphs on Symmetric Groups, 2024*.
- [67] Abrar Ahmad, M. Khalid Mahmood and Daud Ahmad. *Complex Pythagorean Neutrosophic Dombi Fuzzy Graph: Novel Investigations and Applications, 2024*.
- [68] Abrar Ahmad, M. Khalid Mahmood and Daud Ahmad. *Complex Spherical Fuzzy Graphs with Application, 2024*.
- [69] Shakir Mahmood and M. Khalid Mahmood. *Some Molecular Descriptors and Their Polynomials for Molecular Graphs of Celecoxib, Bupivacaine, Budesonide, 2024*.
- [70] Asif Abd-ur-ehman and M. Khalid Mahmood. *On Comparison of Connections and Degree Based Topological Indices for Crystal Cubic Carbons, 2023*.
- [71] Asif Abd-ur-ehman and M. Khalid Mahmood. *The Energy of the Conjugate Graph of Generalized Quaternion Group  $Q_{4m}$ , 2023*.
- [72] Asif Abd-ur-ehman and M. Khalid Mahmood. *Computing Upper Bound Sequences of  $Idimf(G)$  of Rotationally Symmetric Triangular Planar Network constructed as a Halin Graph from Six Vertex Tree, 2023*.

## Work in Progress

- [73] Aneela and M. Khalid Mahmood. *On Regular and Singular Over partitions*.
- [74] M. Khalid Mahmood and Asif Sufyan. *On Fundamental Theorems of Fuzzy Isomorphism of  $\alpha$ -Fuzzy Subgroups*.
- [75] Asif Abd-ur-ehman and M. Khalid Mahmood. *On Upper Bound Sequences of Certain Families of Divisor Euler Function Graphs via Fractional and Local Fractional Metric Dimensions*.
- [76] Awais Ahmad, M. Khalid Mahmood. *On Distance-Degree Based Topological Indices for Hourglass and Circumcoronene Series of Benzenoid Systems*.
- [77] Shakir Mahmood and M. Khalid Mahmood. *Molecular Descriptor and their Shannon Entropies for Amphotericin B Structure*.
- [78] Asma Ehsan, M. Khalid Mahmood. *Mathematical Modelling for Identifying Biomarker Peptides Bounded with Metal Binding Clusters*
- [79] M. Khalid Mahmood, Abrar Ahmad, and Yaser Daanial Khan. *Using Mathematical Modeling and Statistical*

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## Grant/Project

- 2017-18 **Project Grant 2017-18 No. D/4112/Est.1 dated 13-09-2017 (serial No.77)**, University of the Punjab, Lahore, Pakistan.  
Dated: Sep 09, 2017
- 2015-16 **Project 2015-16, D/605/Est.1 dated 02-02-2015 (serial No.605)**, University of the Punjab, Lahore, Pakistan.  
Dated: Feb 02, 2015

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## Conferences / Workshops / Seminars

- 2023 **Attended Departmental Seminar Series**, Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2022 **NATIONAL UNDERGRADUATE MATHEMATICS CONTEST**; Member of organizing committee and evaluation committee, Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2022 PU-NMS- International Schools Series for Students and Faculty  
**Arranged and Attended a Workshop on Interpolations Formulae, Groups and Algebraic Curves**  
Prof. Michel Waldschmidt and Prof. Michel Jambu  
Department of Mathematics, University of the Punjab, Quaid-e-Azam Campus, Lahore
- 2021 **NATIONAL UNDERGRADUATE MATHEMATICS CONTEST**; Member of organizing committee and evaluation committee, Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2020 Attended a Seminar on Conflict Resolution Strategies at Department of Mathematics, University of the Punjab, Lahore, Pakistan
- 2019 **Attended and Presented a Conference paper, IEEE processing**  
University of Management and Technology, Department of Computer Science
- 2018 **Attended and Presented a Conference paper, IEEE processing**  
University of Management and Technology, Department of Computer Science
- 2020 Lecture Series and Discussion on Introduction to Peace Building and Conflict Transformation, University of the Punjab, Lahore, Pakistan.
- 2019-2001 **Attended Departmental Seminar Series** Department of Mathematics, University of the Pnjab, Lahore, Pakistan.
- 2019 **Delivered a Seminar as Invited Speaker** on Geometry and Topology at Department of Mathematics, Government Women College, Sati-lite Town, Gujranwala.
- 2018 **Delivered a Seminar as Invited Speaker** on Construction of Groups at Department of Mathematics, Government Women College, Sati-lite Town, Gujranwala.
- 2018, 2014 **Attended** International Conference ICORE on Education, PU, Pakistan.
- 2018-2017 **Delivered a Seminar as Invited Speaker** on Uniform Convergence and R. Integrals at Department of Mathematics, Government Women College, Satilite Town, Gujranwala.
- 2018-2017 **Delivered a Seminar as Invited Speaker** on Symmetries of Groups at Mathematics Department, Government College, Sheikhpura.
- 2017 **Attended** 1<sup>st</sup>-LGU National Conference on Pure and Applied Mathematics (1st GNCPAM-2017), organized by Lahore Garrison University, DHA Phase IV, Lahore-PAKISTAN.
- 2015 **Delivered a Seminar as Invited Speaker** on Role of Statistical Moments in Image Recognition at University of Central Punjab.
- 2014 **Delivered a Seminar** on Structures of Discrete Graphs and Modular Arithmetics at Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2013 **Delivered a Seminar** on Simple Graphs Arising from Congruences at Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2013 Workshop: **Indigenous On-Campus Training Program** conducted by University of the Punjab, Lahore, Pakistan.

- 2012 **Delivered a Seminar** on Degree Reduction of Congruences at Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2011 **Delivered a Seminar** on Applications of Congruences at Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2009 **Delivered a Seminar** on Classification of the Elements of  $Q^*(\sqrt{n})$  via Congruences and the Modular Group  $PSL(2, Z)$  at Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2008 **Delivered a Seminar** on G-subsets of  $Q^*(\sqrt{n})$  by  $PSL(2, Z)$  at Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2007 **Delivered a Seminar as Invited Speaker** on Rings and Vector Spaces at Mathematics Department, Queen Marry College, Lahore.
- 2006 **Delivered a Seminar as Invited Speaker** on Group Theory at Mathematics Department Queen Marry College, Lahore.
- 2005 **Delivered a Seminar** on Group Representations at Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2010 **Attended** Conference, General Relativity and Gravitation, Department of Mathematics, University of the Punjab, Lahore, Pakistan.
- 2002 Orientation Program: **First HRDC National Faculty Orientation Program**, Public Administration, University of the Punjab, Lahore, Pakistan.

## Professional Membership

- Member Punjab Mathematical Society, Lahore, Pakistan
- Member Pakistan Mathematical Society, Islamabad, Pakistan

## Professional Activities

### Reviewer

- 2024 PLOS ONE  
<https://journals.plos.org/plosone/>
- 2023 TWMS JOURNAL OF APPLIED AND ENGINEERING MATHEMATICS (TWMS J. App. Eng. Math.)  
<https://jaem.isikun.edu.tr/web/>
- 2022 Integers: Electronic Journal of Combinatorial Number Theory  
<https://math.colgate.edu/~integers/>
- 2021 Journal of Function Spaces (JFS)  
<https://www.hindawi.com/journals/jfs/>
- 2020 VFAST Transactions on Software Engineering (VFAST)  
<https://vfast.org/journals/index.php/VTSE/index>
- 2019 VFAST Transactions on Mathematics (VFAST)  
<http://vfast-iccass.com/>
- 2018 Journal of Applied Mathematics  
<https://onlinelibrary.wiley.com/journal/4185>
- 2017 Abstract and Applied Analysis  
<https://onlinelibrary.wiley.com/journal/4058>
- 2016 Punjab University Journal of Mathematics  
<https://pu.edu.pk/home/journal/pujm>

## Administrative Assistance

2004-2007, 2016-2018, 2024-to-date	Member, Board of Faculty of Sciences, University of the Punjab, Lahore, Pakistan
2016- 2018 and 2020-to-date	Member Departmental Doctoral Programme Committee (DDPC), Department of Mathematics, University of the Punjab, Lahore.
2001-to-date	Member Academic Staff Association, University of the Punjab, Lahore.
2003-2006, 2009-2012, 2017-2022	Member Departmental Purchase Committee, Department of Mathematics, University of the Punjab, Lahore.
2001-2003, 2009-2012, 2016- 2018 and 2020-todate	Member Board of Studies, Department of Mathematics, University of the Punjab, Lahore.
2001-2002, 2003-2008, 2010-2011	Student's Advisor, Department of Mathematics, University of the Punjab, Lahore.
2001-2002, 2003-2008, 2010-2011	Member, Departmental Scholarship Committee, University of the Punjab, Lahore.
2005, 2024	Revised BS 4-years/ M.Phil/PhD Syllabi, University of the Punjab, Lahore.
2004-2007	Member, Departmental Library Committee, University of the Punjab, Lahore.
2014-2024	Focal Person, Departmental Career Counselling and Placement Center
2001-2010, 2013-2019	Member Departmental Examination Committee, University of the Punjab, Lahore.
2001-to-date	Assistant Editor Punjab University Journal of Mathematics, University of the Punjab, Lahore.
2001-2007	Staff Secretary, Department of Mathematics, University of the Punjab, Lahore.
1997-2000	Head Disciplinary Committee, Muslim Post Graduate College, Lahore.
1999-2001	Member, Disciplinary Committee, University of Central Punjab, Lahore.
1997-2000	In Charge Departmental Seminars, Muslim Post Graduate Collage, Lahore.
1997-2000	Student's Advisor,, Muslim Post Graduate Collage, Lahore.
1999-2001	Member Examinations, Department of Mathematics, University of Central Punjab, Lahore.
1999-2001	In Charge, Hill Station Tours, University of Central Punjab, Lahore.
2001-2007	Assistant Superintendent, Boys Hostel No:7, University of the Punjab, Lahore.



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## Fields of Interest

- Number Theory
- Analysis ( Real, Complex, Functional and Calculus)
- Group Theory
- Algebra ( Linear and Abstract)
- Topology
- Graph Theory
- Probability and Distributions
- Discrete Mathematics
- Combinatorics
- Mathematical Modeling via Statistical Distributions

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## Language Skills

English	Proficiency in reading, writing and speaking
Urdu	Native
Punjabi	Mother tongue

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## References

- 1 Prof. Dr. Muhammad Akram, Dean, Faculty of Science, University of the Punjab, Lahore, Pakistan.  
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## YouTube-Lecture Series (Group Theory)

- Lecture-1 Conjugacy Relation Between the Elements in a Group  
<https://youtu.be/xq6bAfKNPmw>
- Lecture-2 Class-Equation and Conjugacy Classes of Dihedral Groups  $D_n$   
<https://youtu.be/pe9sJ5A2KBw>
- Lecture-3 Conjugacy Classes of  $S_n$  : A Computational Approach  
<https://youtu.be/mdmG1AVeRQA>
- Lecture-4 Size of Conjugacy Classes of  $S_n$  and  $A_n$  with Class-Equations  
<https://youtu.be/tyStctXvKJs>
- Lecture-5 Conjugacy Classes and Their Size: An Alternative Approach  
<https://youtu.be/YgLHEu2X7IE>
- Lecture-6  $p$ -Groups: Definition and Related Theorems  
<https://youtu.be/P5YaYj1eg08>
- Lecture-7  $p$ -group Continued...  
<https://youtu.be/ZZEAwGlyzOU>
- Lecture-8 Cauchy's Theorems: Abelian and Non-Abelian Cases  
<https://youtu.be/H3P08q7FFjE>

- Lecture-9 Sylow- $p$  Subgroup, Examples and Sylow First Theorem  
<https://youtu.be/WiuKUv5m0YY>
- Lecture-10 Double Cosets and Examples with Related Theorems  
<https://youtu.be/uBTfY8oN8qo>
- Lecture-11 Sylow Second Theorem: Proof and Consequences  
<https://youtu.be/gwKJX7JbSkI>
- Lecture-12 Sylow's Third Theorem : Statement and Discussion  
<https://youtu.be/JUtWImZI6cY>
- Lecture-13 Proof of Sylow's Third Theorem  
<https://youtu.be/8FgK2pGyqs8>
- Lecture-14 Converse of Lagrange Theorem, Importance of Sylow Theory and Consequences  
[https://youtu.be/wJ\\_0eAWuIpM](https://youtu.be/wJ_0eAWuIpM)
- Lecture-15 Sylow's Theorems :Consequences Continued...  
[https://youtu.be/z\\_oh8cZE8N4](https://youtu.be/z_oh8cZE8N4)
- Lecture-16 Remaining of Lec-15  
<https://youtu.be/-hr-wjXFh5w>
- Lecture-17 Sylow's Theorems: A Normal Subgroup and Normalizers of Sylow's- $p$  Subgroups  
<https://youtu.be/3PoXT9j7Qnc>
- Lecture-18 Sylow's Theorems: A group of Order  $pq$  as Cyclic and a Decomposition of  $G$   
<https://youtu.be/GZtYlI3PAes>
- Lecture-19 Applications of Sylow's Theorems: Groups of order 6, 15, and  $2p$   
<https://youtu.be/Ioqk8VSy25E>
- Lecture-20 Applications of Sylow's Theorems: Classification of Groups of order 30  
<https://youtu.be/f-Vb2EbLxQI>

## YouTube-Lecture Series (Topology)

- Lecture-1 A Brief Introduction and Definition  
<https://youtu.be/urpfcUhbi-w>
- Lecture-2 Types of Topological Spaces  
<https://youtu.be/UqNAVtUtNSA>
- Lecture-3 Co-finite and Relative Topology  
<https://youtu.be/tXsB7UJshek>
- Lecture-4 Open and Closed Sets  
<https://youtu.be/7Pf9nQWpwr4>
- Lecture-5 Conjugacy Relation Between the Elements in a Group  
<https://youtu.be/Jjw3LR3qqrM>
- Lecture-6 Interior Point and Interior of a Subset in a Topological Space  
<https://youtu.be/WYmB7NcLNic>
- Lecture-7 Exterior and Boundary of a Subset in a Topological Space  
<https://youtu.be/dUJclmuMBCE>
- Lecture-8 Frontier (of boundary) and Related Theorems  
<https://youtu.be/TzaTe7lCxL8>
- Lecture-9 Definition of Limit Point of a Subset in Topological Space  
<https://youtu.be/YlOEdg6hnqM>
- Lecture-10 Derived Subset, Dense Subset and Separable Spaces  
<https://youtu.be/gmgexfgUDc0>
- Lecture-11 Base for a Topology  
<https://youtu.be/xroUy5RophM>
- Lecture-12 Base for a Topology (Continued)  
<https://youtu.be/tZbnxfrVAQI>

- Lecture-13 Base for a Topology Continued  
<https://youtu.be/dC2Q2Dovb70>
- Lecture-14 Sub base for a Topology  
<https://youtu.be/bkeRosF0h-U>
- Lecture-15 Neighborhood and Neighborhood System of a Point  
[https://youtu.be/yyoKj\\_wtqKk](https://youtu.be/yyoKj_wtqKk)
- Lecture-16 Neighborhood or Local Base (or base at a point of X)  
<https://youtu.be/SYtryJgyfu8>
- Lecture-17 First and Second Countable Topological Spaces (Local and Global)  
<https://youtu.be/WCD1R4LFSak>
- Lecture-18 Lindelof Space  
<https://youtu.be/MCEE29Q9cvQ>
- Lecture-19 Results on Lindelof and Separable Spaces  
<https://youtu.be/n0YnetWCy4Y>
- Lecture-20 A Countable Base in a Separable Metric Space  
<https://youtu.be/2zX2w3C3XSI>
- Lecture-21 A Basic Definition of Continuity in Topology  
<https://youtu.be/Rooy0i9GEL8>
- Lecture-22 Continuity in Topology: A Comparison with Real Analysis  
<https://youtu.be/LwoDf8zjXmc?>
- Lecture-23 Examples of Continuous Functions in Topology  
<https://youtu.be/lkt2vKIV90g>
- Lecture-24 Theorems On Continuous Functions in Topology  
<https://youtu.be/lkt2vKIV90g?>

## YouTube-Lecture Series (Real Analysis-I)

- Lecture-1 Sets and Operations on Sets  
<https://youtu.be/EnUDMsya8X8>
- Lecture-2 Relation and Types of Relations  
<https://youtu.be/TCqQeubst2M>
- Lecture-3 Types of Functions  
[https://youtu.be/XD\\_HFdC-Hu8](https://youtu.be/XD_HFdC-Hu8)
- Lecture-4 Functions Continued...  
[https://youtu.be/hT2wdGCj\\_G0](https://youtu.be/hT2wdGCj_G0)
- Lecture-5 Algebraic and Order Properties of Real Numbers  
<https://youtu.be/XafyZmI95mQ>
- Lecture-6 Methods of Proofs Continued  
<https://youtu.be/m4q3Et7vvk0>
- Lecture-7 Complete and Incomplete Ordered Fields  
<https://youtu.be/0Kh0ympI2Gw>
- Lecture-8 Properties of Suprimum and Infimum  
<https://youtu.be/RAB00MfA-ks>
- Lecture-9 Properties of Suprimum and Infimum Continued  
<https://youtu.be/p8E68BJ2oSY>
- Lecture-10 <https://youtu.be/p8E68BJ2oSY>  
<https://youtu.be/h3TBIhKJfuM>
- Lecture-11 Archimedean and Condensation Properties  
<https://youtu.be/CP7zGXogr-k>
- Lecture-12 Existence and Uniqueness of Positive Nth Root of Positive Numbers  
<https://youtu.be/WPBQeMamEd8>

- Lecture-13 Schwarz Inequality and Euclidean Spaces  
<https://youtu.be/1cLbMZUNgok>
- Lecture-14 Sequences and Their Convergence  
<https://youtu.be/mwkY46zJdc8>
- Lecture-15 Bounded Sequences and Limit Theorems  
<https://youtu.be/ynZulAHxWTo>
- Lecture-16 Applications of Sandwich Theorem  
<https://youtu.be/cVt71hMupkw>
- Lecture-17 Monotone Bounded Sequences  
<https://youtu.be/uGE1bmFj5p8>
- Lecture-18 Applications of Monotone Convergence Theorem  
<https://youtu.be/wBjooPegMvc>
- Lecture-19 Monotone Subsequence and Bolzano Weirstrass Theorems  
<https://youtu.be/ctH0yAykS1E>
- Lecture-20 Cauchy Sequence  
<https://youtu.be/UqyxLwqVQ-4>
- Lecture-21 Contractive as Cauchy (or Convergent) Sequence of Real Numbers  
<https://youtu.be/H3csaQOBVmU>
- Lecture-22 Divergent and Properly Divergent Sequences  
<https://youtu.be/4wXf4D4uSAU>
- Lecture-23 Infinite Series: A brief Introduction  
[https://youtu.be/QOV\\_Q1epZ7Y](https://youtu.be/QOV_Q1epZ7Y)
- Lecture-24 Convergence of Positive Term Series and Cauchy Criterion for Series  
[https://youtu.be/9RUF836\\_Msc](https://youtu.be/9RUF836_Msc)
- Lecture-25 Cauchy Condensation Test with Applications  
[https://youtu.be/00jIS61Uw\\_g](https://youtu.be/00jIS61Uw_g)
- Lecture-26 Comparison, Limit Comparison, Ratio and Root Tests  
<https://youtu.be/FsO-hCmfKds>
- Lecture-27 The Completeness Property of Real Numbers  
<https://youtu.be/KTqENC3KzWQ>
- Lecture-28 Alternating Series Test. Dirichlet's and Abel's Tests  
<https://youtu.be/q8ZHpvGH6VI>
- Lecture-29 Grouping of Series  
<https://youtu.be/udXESonA3Zk>
- Lecture-30 Rearrangement of Series  
<https://youtu.be/UQotdehokQg>
- Lecture-31 Limits of Functions  
<https://youtu.be/SgEmKb112WU>
- Lecture-32 Limits of Functions Continued  
<https://youtu.be/REo4VSNYSxk>
- Lecture-33 Sequential Criterion for Limits of Functions  
<https://youtu.be/xWH0WmU7GWA>
- Lecture-34 Divergence Criterion for Limits and Applications  
<https://youtu.be/3A7euFJf5ZM>
- Lecture-35 Bounded Functions  
<https://youtu.be/HAbxwSWOxac>
- Lecture-36 Bounded Functions Continued...  
<https://youtu.be/cDyaCUuD5S4>
- Lecture-37 Bounded Functions and Compact Sets  
[https://youtu.be/bW4QL5e\\_iOg](https://youtu.be/bW4QL5e_iOg)
- Lecture-38 Proofs of Limit Theorems  
<https://youtu.be/9sSZyL4mhR4>

- Lecture-39 Limit Theorems with Applications  
<https://youtu.be/IQBWghJC8V4>
- Lecture-40 Extensions of Limits: Definition and Examples  
[https://youtu.be/D46Yf\\_gtAxM](https://youtu.be/D46Yf_gtAxM)
- Lecture-41 One Sided Limits for Monotone Function  
<https://youtu.be/BPPB6aZaZhE>
- Lecture-42 Limits: Monotone Functions Continued  
[https://youtu.be/-J\\_E3qIfenU](https://youtu.be/-J_E3qIfenU)
- Lecture-43 Continuity at a Point: Definition  
<https://youtu.be/YkOagOjNFyU>
- Lecture-44 Classifications of Discontinuities  
<https://youtu.be/UKR4-KIAvVU>
- Lecture-45 Composition of Continuous Functions  
<https://youtu.be/lZdJqCUccB0>
- Lecture-46 Continuous Functions on Intervals  
<https://youtu.be/TUeFYtVHGbE>
- Lecture-47 Continuity on Intervals Continued  
<https://youtu.be/uiosKPCpBXY>
- Lecture-48 Location of Roots Via Nested Intervals Property  
<https://youtu.be/C6egUO-FtxY>
- Lecture-49 Bolzano's Intermediate Value and Brower's Theorem  
<https://youtu.be/UisRoWi7RAY>
- Lecture-50 Uniform Continuity and Continuity at a Point  
<https://youtu.be/Ezk3bVaDrg>
- Lecture-51 Uniform Continuity: More Explanations With Examples  
<https://youtu.be/xq6bAfKNPmw>
- Lecture-52 A Non-Uniform Continuity Criterion and Uniform Continuity Theorem  
<https://youtu.be/3ot2CzYk2VQ>

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## YouTube-Lecture Series (Real Analysis-II)

- Lecture-1 A Brief Introduction to Riemann Integrals  
<https://www.youtube.com/watch?v=d-QRtmVvAoA&t=14s>
- Lecture-2 Existence of Lower and Upper Sums and Riemann Integrals  
<https://www.youtube.com/watch?v=gvUGH7WZrEU>