Muhammad Tayyab

Curriculum Vitae

"GOD made the integers, all else is the work of man" - Leopold Kronecker

Current Position

Feb 2023 – present **Assistant Professor of Mathematics**, *School of Computing, Pak-Austria Fachhochschule Institute of Applied Sciences and Technology*, Haripur, Pakistan.

- Teach undergraduate and graduate courses in mathematics
- Supervise student research projects and theses
- Conduct and publish research in areas of applied mathematics, mathematical modeling, statistical mechanics, and dynamical systems
- Participate in curriculum development and academic planning
- Serve on various academic and administrative committees
- Mentor students and provide academic advising

Previous Employments

Jan 2019 – Jan 2023 **Assistant Professor of Mathematics**, *Faculty of Engineering Sciences, Ghulam Ishaq Khan Institute of Engineering Sciences and Technology*, Swabi, Pakistan.

- Taught undergraduate and graduate courses
- Supervised postgraduate student research
- Conducted and published independent and collaborative research
- Developed course materials and assessments
- Participated in departmental meetings and decision-making processes

Nov 2014 – 2018 **Ph.D. Researcher**, *Department of Mathematical Sciences,* Politecnico di Torino & Università degli studi di Torino, Torino, Italy.

May 2014 – Nov 2014 **Research Associate**, *Department of Mathematics, COMSATS University*, Islamabad, Pakistan.

- Conducted research on inverse problems

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LinkedIn

Sep 2014 – Nov 2014 **Adjunct Faculty**, *Department of Mathematics and Statistics, Institute of Space Technology*, Islamabad, Pakistan.
- Taught undergraduate courses

Education

2014–2018 **Ph.D. in Pure and Applied Mathematics, Department of Mathematical Sciences**, Politecnico di Torino & Università degli studi di Torino, Italy.
- Distinguished Ph.D, Won Prime Quality Award
- Thesis: "The Slicer Map: Moments, Correlations and Universality"
  - This work involved the mathematical modeling of deterministic and stochastic dynamical systems to understand anomalous transport phenomena
- Advisor: L. Rondoni, Co-Advisors: C. Giberti & J. Vollmer
- Research Focus: Statistical Mechanics, Deterministic and Stochastic processes, Dynamical Systems, Anomalous Transport, correlations, Data Analysis and Numerical Simulations
- Visiting Ph.D. student at Institut für Theoretische Physik: ITP - Universität Leipzig, Germany
- Core Courses:
  - Non-Equilibrium Statistical Mechanics
  - Stochastic Processes
  - Mathematical Theory of Dilute Gases
  - Introduction to Dynamical System
  - Non Linear evolution PDEs (studied at Hausdorff center for mathematics, University of Bonn, Germany)

2012–2014 **Masters of science in Mathematics**, *COMSATS University, Islamabad*, Pakistan, *GPA – 3.59/4.00*.
- Thesis: "On the Inverse Source Problem for Time Fractional Diffusion Equation"
  - This work comprises Direct and Inverse Source Problem for time fractional diffusion equation. Participated in numerous results including existence, uniqueness and continuous dependence on data
- Advisor: Salman A. Malik
- Core Courses: Perturbation Methods for ODEs & PDEs, Numerical Solution of PDEs, Elastodynamics, Advanced Numerical Analysis, Differential Equations, Numerical Linear Algebra

2008–2012 **Bachelor of Science in Mathematics**, *International Islamic university Islamabad*, Pakistan, *GPA – 3.22/4.00*.

2006–2008 **Higher Secondary School**, *Government Post Graduate College Jhelum*, Pakistan.

2004–2006 **Secondary School Certificate**, *Government M.C. Islamia High School Jhelum*, Pakistan.

Research Interest

My research focuses on mathematical modeling of deterministic and stochastic processes, statistical mechanics, anomalous transport, numerical simulations and data analysis. I am dedicated to unraveling the underlying principles that govern complex phenomena, bridging theory and practice to address real-world challenges.

Keywords

- Mathematical modeling
- Dynamical systems
- Physical systems
- Statistical physics

Selected Journal Publications

Generalized autocorrelation function in the family of deterministic and stochastic anomalous diffusion dynamics, M. Tayyab (solo author), *Phys. Rev. Res.*, ***6***, *033169, 2024 American Physical Society IF: 4.2*. `arXiv:2408.02989v2`

Displacement autocorrelation functions for strong anomalous diffusion: A scaling form, universal behavior, and corrections to scaling, M. Tayyab (with J. Vollmer, L. Rondoni, C. Giberti and C. M. Monasterio), *Phys. Rev. Res.*, ***3***, *013067, 2021 American Physical Society IF: 4.2* .

Scrutinizing the charge storage mechanism in SrO based composites for asymmetric supercapacitors by diffusion-controlled process, Iqbal, M.Z., Zakar, S., Tayyab, M. et al.), *Appl Nanosci-Springer,* 2020 IF: 3.8.

Capacitive and diffusion-controlled mechanism of strontium oxide based symmetric and asymmetric devices, M. Tayyab (with M. Z. Iqbal et al.), *J. Energy Storage-Elsevier,* 20 101056, 2020 IF: 9.4.

Equivalence of position-position auto-correlations in the Slicer Map and Lévy-Lorentz gas, M. Tayyab (with C. Giberti, L. Rondoni and J. Vollmer), Nonlinearity-IOP, 32(6):2302-2326, 2019 IF: 1.934.

Computing μ values for real and mixed μ problems, M. Tayyab (with M. Rehman and F. Anwar), *Mathematics-MDPI,* 7(9) 821, 2019 IF: 2.4.

Universal strong anomalous diffusion, M. Tayyab (with J. Vollmer, L. Rondoni, C. Giberti and C. M. Monasterio), Frontiers in Physics, Interdisciplinary Physics (Special issue, Invited article) (**abstract accepted**) .

The uniqueness, existence and stability analysis of linear evolution variational inequalities, M. Tayyab (with M. Rehman, R. Latif, F. Amir and T. Rasuolv), (Under Revision).

Strong overlapping of anomalously diffusive deterministic and stochastic dynamics in a super-diffusive regime, M. Tayyab and J. Tariq, (in submission).

Reseacrh Experience

May 2014 – Dec 2014 **Research Associate**, *COMSATS University, Islamabad*, Pakistan.

- Project: Higher Education Commission funded "Direct and Inverse Problems for Time Fractional Diffusion Equation"
- Responsibilities:
  - Worked on time-dependent source term for diffusion equation with fractional derivative in time.
  - Proved the uniqueness and existence of solutions using bi-orthogonal system of functions.

Students Supervision

Aug 2021 to Jan 2023 **Master's Student**, *Misbah Shaheen*, Completed her master's in Fall 2022 on the mathematical modeling.

Jan 2020 to July 2021 **Master's Student**, *Jahanzeb Tariq*, Completed his Master's in spring 2021 on the anomalous diffusion models.

Jan 2020 to July 2021 **Master's Student**, *Misha Kashif*, Completed her Master's in spring 2021 on the mathematical modeling of energy storage devices.

Examiner

2023 External examiner of master's student, Muhammad Yasir at IBA Sukkur University

2023 External examiner of master's student, Ziaudin at IBA Sukkur University

2023 Ph.D. qualifying exam evaluator of Sana Tahir at GIKI

2022 Internal examiner of Ph.D. student, Sadaf Shaheen at GIKI

2022 Internal examiner of Ph.D. student, Shabeebla Malik at GIKI

2022 Internal examiner of Ph.D. student, Shams ul Arfeen at GIKI

2021 Internal examiner of master's student, Sana Zakir at GIKI

Teaching Activity

Graduate Courses

Fall 2022 **Special Topic in Applied Mathematics**, *08 students*, 37.5 hrs.
Taught different dynamics of anomalous diffusion processes, deterministic and stochastic dynamics and their universal behavior, GIKI.

Fall 2024 **Tools and Techniques in Data Science**, *25 students*, 45 hrs.
I will mathematical techniques and computational tools like statistical methods, linear algebra, data visualization and optimization to analyze and interpret data in data science, PAF-IAST.

Undergraduate Courses

Fall 2023, Spring 2024 **Linear Algebra**, *80 students*, 45 hrs.
Teach linear algebra and their applications to real life problems, PAF-IAST.

Fall 2023 **Numerical Computations**, *30 students*, 30 hrs.
Taught iterative methods, root finding problems, and numerical computations, PAF-IAST.

Spring 2023 **Calculus and Analytical geometry**, *70 students*, 40 hrs.
Taught fundamental of mathematics and their applications, PAF-IAST.

Spring 2023 **Differential Equations**, *30 students*, 40 hrs.
Taught methods of solving differential equations and their real life applications, PAF-IAST.

Spring 2023 **Linear Algebra and Differential Equations**, *34 students*, 40 hrs.
Taught several matrix operations and their real life applications and connect with differential equations, PAF-IAST.

Fall 2022 **Calculus-I**, *77 students*, 37.5 hrs.
Taught fundamental of mathematics and their applications, GIKI.

Spring 2022 **Numerical Analysis**, *80 students*, 37.5 hrs.
Taught iterative methods, root finding problems, and numerical computations GIKI.

Spring 2022 **Calculus-II**, *60 students*, 37.5 hrs.
Taught multivariable Calculus and their applications, GIKI.

Fall 2021 **Calculus-I**, *Two sections-70 students in each section*, 37.5 hrs.
Taught fundamental of mathematics and their applications, GIKI.

Summer 2021 **Calculus-II**, *43 students*, 37.5 hrs.
Taught multivariable Calculus and their applications, GIKI.

Spring 2021 **Engineering Statistics**, *94 students*, 37.5 hrs.
Taught Probability, statistics and their related problems, GIKI.

Spring 2021 **Multivariable Calculus**, *85 students*, 37.5 hrs.
Taught multivariable Calculus and their applications, GIKI.

Fall 2020 **Numerical Analysis**, *80 students*, 37.5 hrs.
Teaching iterative methods and root finding problems, GIKI.

Summer 2020 **Calculus-II**, *40 students*, 37.5 hrs, Taught online due to COVID-19.
Taught multivariable Calculus and their applications, GIKI.

Spring 2020 **Calculus-II**, *100 students in each two sections*, 37.5 hrs.
Taught multivariable Calculus and their applications, GIKI.

Spring 2020 **Calculus-II**, *100 students in each two sections*, 37.5 hrs.
Taught multivariable Calculus and their applications, GIKI.

Fall 2019 **Calculus-I**, *100 students in each two sections*, 37.5 hrs.
Taught fundamentals of mathematics and their applications, GIKI.

Summer 2019 **Calculus-II**, *37 students*, 37.5 hrs.
Taught multivariable Calculus and their applications, GIKI.

Spring 2019 **Calculus-II**, *100 students in each two sections*, 37.5 hrs.
Taught multivariable Calculus and their applications, GIKI.

Fall 2014 **Calculus-I**, *60 students*, 30 hrs.
Taught fundamentals of mathematics. Institute of space technology, Islamabad.

Fall 2014 **Calculus-II**, *30 students*, 30 hrs.
Taught multivariable Calculus and their applications. Institute of space technology, Islamabad.

Contribution in Academic and Administrative committees

Data science students advisor, since Feb 2023, PAF-IAST.

"Curriculum Development Committee", developed the curriculum for BS in Mathematics and Data Analytics, GIKI.

Convener of PEO committee, GIKI.

Member of senior design project committee based on OBE, GIKI.

Member of documentation and Lab files including CLOs/PLOs mapping and CQIs, GIKI.

Member of CLOs committee.

Member of graduate prospectus and SAR Applied Mathematics committee, GIKI.

Member of FES research funding committee, GIKI.

Member of audit of store committee, GIKI.

Member of FES internet portal committee, GIKI.

Reviewer Activity

Several Journal of MDPI

Journal of Molecular Liquids - Elsevier

Neural Computing and Applications - Springer

Applied Mathematics and Information Sciences - Natural Sciences Publishing

Applied Mathematics and Computation - Elsevier

Academic Visits

08 Apr. - 02 May 2018 Visiting Ph.D. student to Prof. Jürgen Vollmer at Institut für Theoretische Physik: ITP - Universität Leipzig, Germany

13 - 24 Mar. 2018 Visit to Prof. Claudio Giberti, University of Modena and Reggio Emilia, Modena, Italy

17 - 18 Nov. 2016 Visit to Prof. Claudio Giberti, University of Modena and Reggio Emilia, Modena, Italy

3 - 4 May 2016 Visit to Prof. Claudio Giberti, University of Modena and Reggio Emilia, Modena, Italy

Awards & Merits

2018 Nominated for Prime Quality Award by Politecnico di Torino, Italy

2017 Prime Quality Award (**Distinguished Doctoral student**) with the amount of 7,000 Euro by Politecnico di Torino, Italy

2014–2017 Fully Funded Ph.D. Scholarship by Università degli di studi Torino & Politecnico di Torino, Italy

2011 Merit Scholarship in Bachelor Degree

Invited Speaker, Conferences, Summer school, Workshops

22 June 2023 Expert lecture colloquia on "**role of linear algebra and differential equations in the real life problem**" PAF-IAST, Haripur

07 October 2022 Research seminar on "**In the search of random walk: dynamics of spatial randomness** " GIKI, Pakistan

27 July 2020 Invited speaker for seminar on "**an insight into anomalous diffusion processes**" PAF-KIET, Karachi

19 March 2019 Invited speaker for seminar on "**anomalous transport: position observables and their equivalence**" COMSATS University Islamabad

03 October 2018 Invited speaker for talk on "**Slicer Map and Lévy-Lorentz gas: equivalence of displacement moments and correlations**" IBA University, Sukkur, Pakistan

24 July 2017 Talk and Poster on "**correlations in non-chaotic map and Lévy-Lorentz gas**" Bruneck, Italy

16-29 July 2017 Summer school on "**fundamental problems in statistical physics XIV**" Bruneck, Italy

18 Jan 2017 Work presented in seminar on "**some aspects of transport processes**" PoliTO, Italy

08–10 September 2016 Poster Presentation, Title: "**correlations in the Slicer Map**" in Workshop *"non-equilibrium statistical mechanics and turbulence"*, Dipartimento di Ingegneria, Sapienza Università di Roma, Italy

11–13 July 2016 Solvay-Workshop "**non-equilibrium and nonlinear phenomena in statistical mechanics"**, International Solvay Institute, Université Libre de Brussels - Campus Plaine, Belgium

13-17 July 2015 Summer School "**nonlinear evolution : kinetic equations and defect dynamics"**, Hausdorff Center for Mathematics, University of Bonn, Germany

16–18 Dec 2013 — 11th International Conference on "**frontiers of information technology (FIT' 13)"** Islamabad, Pakistan

Technical Skills

IT skills — Matlab, Mathemtica, FORTRAN, R, Microsoft applications and LaTeX

Languages

Urdu	**Mothertongue**	*Native speaker*
English	**Fluent**	*Highly professional*
Italian	**Intermediate**	*Conversationally Basic*

Interests

- Violin
- Running
- Cooking
- Photography

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