



## Sukkur IBA University MS & PhD in Mathematics

[www.iba-suk.edu.pk](http://www.iba-suk.edu.pk)

“  
Sukkur IBA University is not just an Educational Institute, it is a thought process, a phenomenon...  
A Silent Revolution.”

**Prof. Nisar Ahmed Siddiqui**  
Vice Chancellor, Sukkur IBA University

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# Sukkur IBA University Vision & Mission

## Vision

"To become a world-class university in the fields of Management Sciences, Information Technology, Engineering, Mathematics and Education."



## Mission

The mission of Sukkur IBA University is to contribute and serve community by imparting knowledge through innovative teaching and applied research at the global levels of excellence. We aim to establish and sustain a competitive meritorious environment by strengthening faculty and using state of the art technology to produce graduates with analytical & creative thinking, leadership skills and entrepreneurial spirit, who possess global outlook and are conscious of ethical values.

# Sukkur IBA University Introduction

## Beginning of a New Era – Spreading the Light of Education

Since its establishment, Sukkur IBA University has been successfully transforming the lives of people and uplifting their careers by offering quality education. Sukkur IBA University welcomes people from diverse backgrounds, majority of them have dreams in their minds but their realization is blur. Sukkur IBA University not only helps them realize their dreams but changes their lives by educating them and making them responsible citizens of Pakistan.

Sukkur IBA University does not believe in teaching through conventional means. It rather focuses on teaching through modern teaching methodology on market-based curriculum. Students are engaged through classroom lectures, video conferences, presentations, audio video learning aids, group discussions, role play exercises, practical projects, research work and other curricular and extracurricular activities. The purpose is to build capacity of students from all aspects by using all modern tools and techniques. This aids in increasing student analytical skills, decision making power and self-confidence, e risk taking thinking out of box, determination and self-awareness. These activities also create a strong link between theory from their books and practical, which they have to face after initiating their career.

## How Sukkur IBA University is Different?

- Quality Education at affordable Cost – what Sukkur IBA University offers and what it charges is far less than other Institutions of similar caliber
- Assurance of Learning – Sukkur IBA University ensures learning through linking programs with institute mission and mapping curriculum to achieve desired academic goals.
- Linkages with reputable national and international institutions – for adopting best national and international academic practices to improve quality of education Sukkur IBA University has strong linkages with institutions of global caliber.
- Raising standard of education through unique foundation semester – to support students from poor academic and financial background to remove their academic deficiencies and prepare them to face challenges of higher education.
- Focus on Faculty Development – to invest a lot on faculty to build their capacity so that they can teach better and prepare students for challenges of professional life.



## Facilities and Infrastructure at Sukkur IBA University



Career Development Center



Video Conferencing

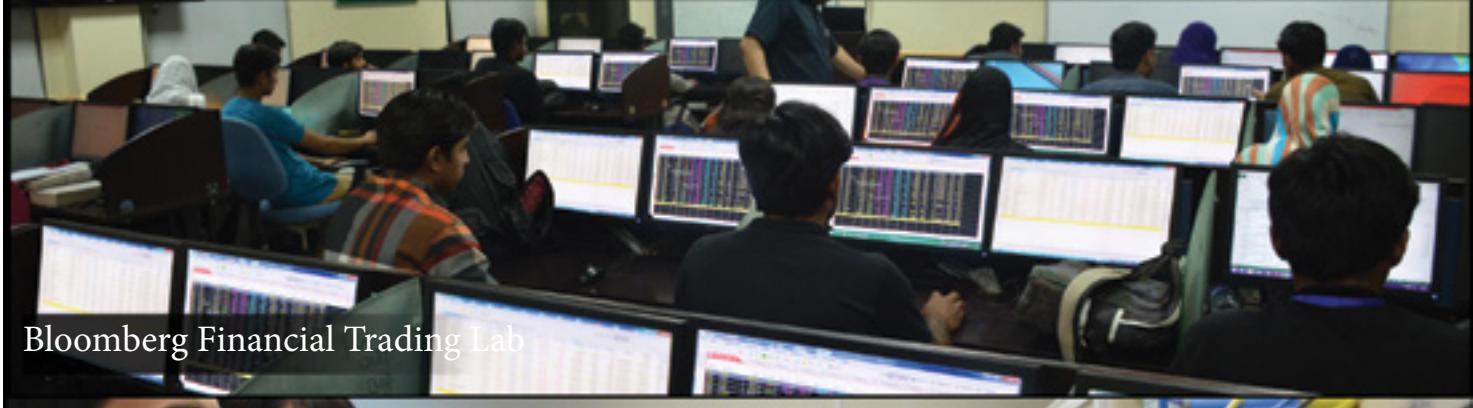


State-of-the-art Central Library

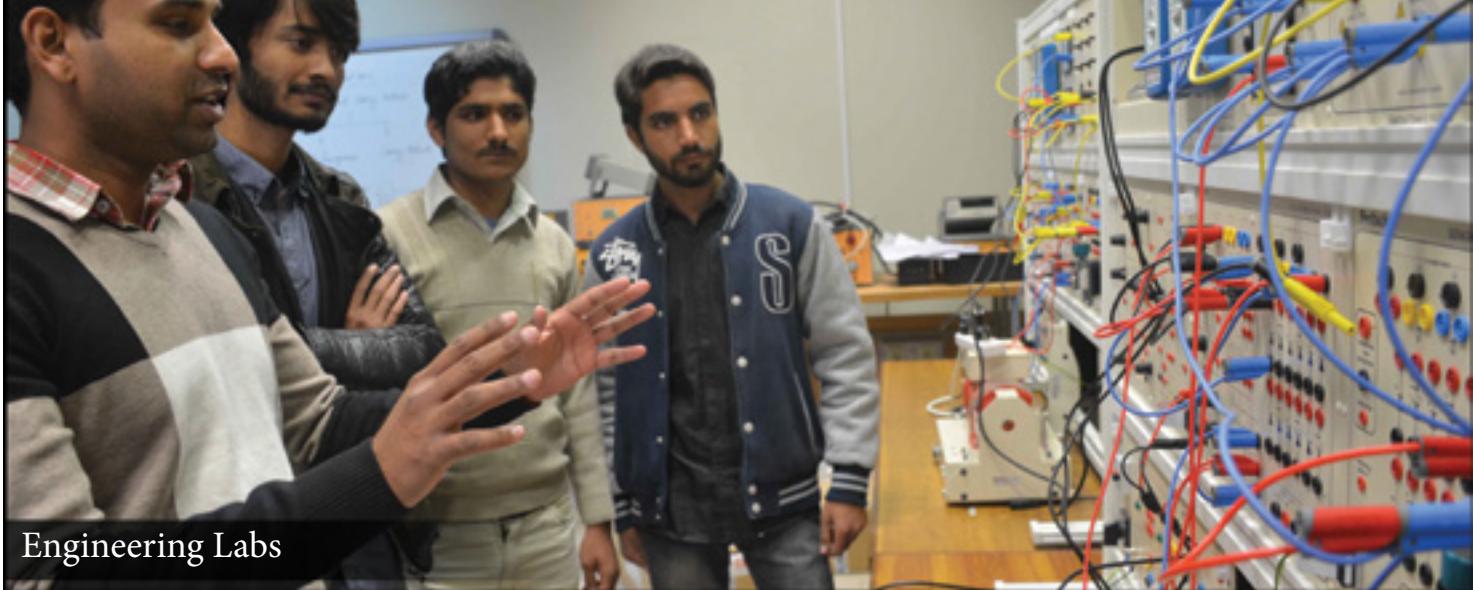
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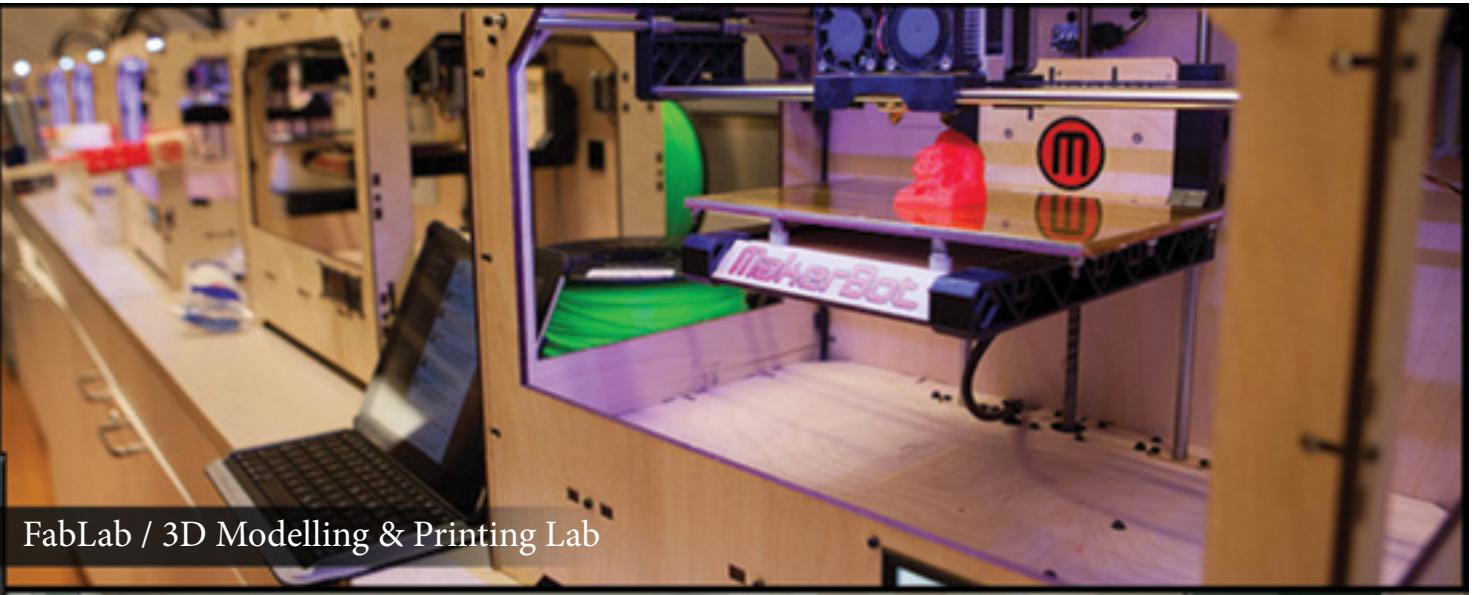
Computer Science/IT Labs



Bloomberg Financial Trading Lab



Engineering Labs



# Introduction to Department of Mathematics

From the inception of the known history, Mathematics has played a central role in the development of science and its progress. Mathematics, as the language of science and engineering, is essential to our study of both nature and technology. The clear logical thought processes that arise from Mathematical studies are extremely valuable in many professions. With this thought in mind, Sukkur IBA University established Department of Mathematics in 2013. The department of Mathematics offers three degree programs; i.e. BS (Mathematics), MS Mathematics and PhD (Mathematics).

## Vision

To become a world leader in theoretical and applied Mathematics.

The values that guide our decisions, strategies and actions are:

- Merit
- Quality
- Excellence
- Community
- Innovation
- Impact

## Mission

The mission of Department of Mathematics and Social Sciences at Sukkur IBA is twofold: first to become the center of excellence in providing the modern quality education of Mathematics, in both respects i.e. Mathematics as a theoretical subject and as a major source for the development of other social and scientific fields; and secondly, to undertake educational outreach and community engagement that increase Mathematical and computing literacy nationally and globally.

## Goals & Objectives

We strive to make an impact on the discipline of Mathematics and on the broader community through the following goals:

- To provide learning opportunities that are unparalleled nationally and globally.
- To produce the graduates that are in demand of national and global level.
- Develop critical thinking and problem solving skills, content knowledge, pedagogical content knowledge and the ability to communicate complex ideas effectively and efficiently.
- Understand the connections within Mathematics, as well as applications of Mathematics to other areas.
- Build the connections with different sections of community such as industry, agriculture and local and national schools and colleges.
- Explore and appreciate the fundamental beauty of nature of Mathematics, its learning and teaching. Moreover, to participate in discovering the new arenas, approaches and techniques to tackle the problems of abstract and applied nature.
- Engage them through modern pedagogies and technology based learning of Mathematics and dependent sciences.
- Cultivate the responsible academic attitude of ethical and professional practices.
- To carry out the theoretical and applied research in Mathematics that has national and worldwide impact and recognition.

# Introduction to MS Program

Sukkur IBA University offers MS in Mathematics. The MS program in Mathematics prepares students for careers in research, applications and academia. The courses and research areas are designed so that students excel in the following fields:

I. Mathematical Finance: Mathematical finance, also known as quantitative finance, is a field of applied Mathematics, concerned with financial markets. Generally, Mathematical finance will derive and extend the Mathematical or numerical models without necessarily establishing a link to financial theory, taking observed market prices as input. Mathematical consistency is required, not compatibility with economic theory. Thus, for example, while a financial economist might study the structural reasons why a company may have a certain share price, a financial Mathematician may take the share price as a given, and attempt to use stochastic calculus to obtain the corresponding value of derivatives of the stock. The fundamental theorem of arbitrage-free pricing is one of the key theorems in Mathematical finance, while the Black–Scholes equation and formula are amongst the key results. Mathematical finance also overlaps heavily with the fields of computational finance and financial engineering. The latter focuses on applications and modeling, often by help of stochastic asset models, while the former focuses, in addition to analysis, on building tools of implementation for the models. In general, there exist two separate branches of finance that require advanced quantitative techniques: derivatives pricing on one hand, and risk- and portfolio management on the other.

II. Abstract Algebra: Algebra is a fundamental and universal language upon which most other branches of Mathematics are built. In recent decades, Algebra has become an increasingly important field of study due to its numerous contemporary applications in physics, chemistry, computer science, data communication and security. Semigroups, groups and rings are abstract algebraic structures and are very important in theoretical computer science, crystallography, quantum physics and cryptography.

III. Fluid Mechanics: Fluid mechanics is the branch of physics that studies the mechanics of fluids (liquids, gases, and plasmas) and the forces on them. Fluid mechanics has a wide range of applications, including for Mechanical Engineering, Chemical Engineering, Geophysics, Astrophysics, and Biology. Fluid Mechanics can be divided into fluid statics, the study of fluids at rest; and fluid dynamics, the study of the effect of forces on fluid motion. Fluid Mechanics, especially Fluid Dynamics, is an active field of research with many problems that are partly or wholly unsolved. Fluid mechanics can be mathematically complex, and can best be solved by numerical methods, typically using computers. A modern discipline, called computational fluid dynamics (CFD), is devoted to this approach to solving fluid mechanics problems.

IV. Computational Mathematics: The Mathematical models in Physics, Geology, Astrophysics, Mechanics, Geophysics, as well as in most engineering disciplines often involve nonlinear differential equations and complex geometric constraints. Besides the applications of such models, one must understand the solution approaches to such systems. It demands an in-depth knowledge of numerical methods, computer simulation and software design. The field of Computational Mathematics addresses these aspects. It enables the students to equip with tools and skills to formulate numerical methods for the solution of system of differential equations and produce associated running algorithms. The course can be divided into basic and advanced level. Also the mathematical models include stationary, unsteady, deterministic and stochastic. The advanced level topics may include the uncertainty quantification and data assimilation procedures.

## Program Goals

The goals and objectives of the MS Mathematics are as follows:

1. To foster excellence in Mathematical research foundation and to offer a strong graduate education that will prepare students for their PhD studies.
2. To develop a level of quantitative literacy and analytical skills among the students in order to enable them to deal effectively with the quantitative issues that they will encounter throughout their lives.
3. To develop competence in those areas most relevant to the scholarly and professional objectives of the students.
4. To make students able to use technology, including specialized computational and graphics software in order to test the validity of certain conjectures, to solve problems, to conduct Mathematical experiments and do Mathematical research.
5. To make students able to effectively disseminate Mathematical knowledge and understanding orally, in writing, or by other means

## Structure of MS Program

### Breakdown of the Marks

Category	Weightage
GAT (General) NTS/STS Test	50%
Academic Performance	25%
Interview	25%

### Distribution of Total Credit Hours

Category of Area	Credit Hours
Core Courses	18
Elective Courses	06
Thesis	06
Total Credit Hours	30

### Roadmap of the Program

Students are required to successfully qualify eight courses each of 3 credit hours duration. On successful completion of MS course work students will be allowed to work on a 06 credit hour thesis on a subject of interest and on the availability of the faculty. The minimum duration of completion of MS Program is 2 years (Four Semesters) and maximum duration is 4 Years and students must pass GAT (General) before applying for the admission.

## Semester-wise Plan

SEMESTER - I			
S. No.	Course Title	Credit Hours	
1.	Elective: To be selected from list of approved courses		03
2.	Elective: To be selected from list of approved courses		03
3.	Elective: To be selected from list of approved courses		03
Total Credit Hours			09

SEMESTER - II			
S. No.	Course Code	Course Title	Credit Hours
1.		Elective: To be selected from list of approved courses	03
2.		Elective: To be selected from list of approved courses	03
3.		Elective: To be selected from list of approved courses	03
4.	ENG-601	Scientific Report Writing	00
Total Credit Hours			09

SEMESTER - III			
S. No.	Course Code	Course Title	Credit Hours
1.		Elective: To be selected from list of approved courses	03
2.		Elective: To be selected from list of approved courses	03
3.	MATH-651	Research Proposal Defense (Discussion with Supervisor and Literature review )	00
Total Credit Hours			06

SEMESTER - IV			
S. No.	Course Code	Course Title	Credit Hours
1.	MATH-651	Submission of Thesis + Final defense	06
Total Credit Hours			06

## Eligibility Criteria

Admission is purely merit-based and depends exclusively on the following factors:

- **Academic Eligibility**

For MS in Mathematics applicant must have (BS/MSc in Mathematics or 16 Years of Education in relevant field) with at least 1st Division or 2.2 CGPA from any HEC recognized University / Institution.

- **Performance in NTS/STS GAT General Test**

The Applicant must have passed the NTS/STS GAT General test for admission.

GAT (General) Test conducted by NTS/STS with minimum 50% cumulative score at the time of admission.

Please see the HEC Minimum Criteria for more detail or follow the link below: [http://hec.gov.pk/english/scholarshipsgrants/Documents MPHIL\\_PhD\\_Criteria.pdf](http://hec.gov.pk/english/scholarshipsgrants/Documents MPHIL_PhD_Criteria.pdf)

- **Interview Performance**

Only shortlisted applicants on the basis of GAT (General) Test conducted by NTS/STS will be invited for interview.



## Introduction to PhD Program

In many disciplines, Mathematics plays an extremely important role ranging from Stochastic Analysis and Models of large scale systems and networks, Financial Mathematics, Statistical Models, Fluid dynamics computations, and risk assessment. Mathematical research, in general, contributes indirectly by supporting the advanced research in a variety of other discipline offered at Sukkur IBA University.

Department of Mathematics offers several courses for the students such as Calculus, Linear Algebra, Analysis, Mathematical Modeling, Probability Theory, Mathematical Finance and Statistics, Discrete Mathematics, and Stochastic processes. The offered coursework is designed to provide basic as well as advance training for the tools of Applied Mathematics, including Numerical Methods, Ordinary, Partial and Stochastic Differential Equations and Scientific Computing. The courses offered build a solid Mathematical background of the students, to further pursue their doctoral research/degree. The graduate program opens opportunity for the students interested in multidisciplinary mathematics projects for their PhD research in the fields of Mathematics.

Sukkur IBA University has about 17 faculty members working in different areas of Mathematics. Mathematics department is offering PhD courses, which are taught by our HEC recognized PhD faculty. The PhD course contents are also designed such that students can improve and enhance their fundamental knowledge which is required to conduct doctoral research in their area of interest. The offered PhD coursework is designed, specifically, to choose from the following research areas of the available faculty members:

- I. Stochastic Analysis and Finance
- II. Abstract Algebra
- III. Fluid Mechanics
- IV. Computational Fluid Dynamics



## **Program Goals**

The objectives of our PhD program in Mathematics are as follows:

1. Provide training for the development of the research capabilities in Mathematics.
2. Building strong foundation in mathematical analysis and its real world applications.
3. Extending the Mathematical thinking and proficiency beyond master level.
4. Contributing in the development of new emerging fields in Applied Mathematics as well as managing the complex interdisciplinary projects.
5. Becoming active in conducting the quality research with professional and ethical integrity.
6. Develop highly trained Mathematicians who can explore and address the Mvathematical needs in other sciences, industry and community.

## **Scope regarding market, social and employment perspective of program**

1. The logical thinking/reasoning and strategic knowledge of Mathematics is highly valued by operational researcher, stockbroker, business and investment analyst. Therefore, the Mathematicians are hired by a wide range of sectors in market, for example by insurance companies, marketing companies, banks, and accountancy firms.
2. Mathematicians have opportunities for employment in many engineering firms, industries, publically funded research institutes or government agencies, and different government departments in Pakistan. Moreover, if one wants to purse career in academia then they can easily find job in some reputed institutes or universities in Pakistan.



## **Structure to PhD Program**

### **Breakdown of the Marks:**

<b>Category</b>	<b>Weightage</b>
GAT (General) NTS/STS Test	50%
Academic Performance	25%
Interview	25%

### **Distribution of Total Credit Hours**

<b>Category of Area</b>	<b>Credit Hours</b>
Courses	18
Thesis	30
Total Credit Hours	48

### **Roadmap of the Program**

As per HEC criteria the minimum and maximum duration to complete Ph.D. is three and six years respectively. The students are required to complete their course work and pass the comprehensive exam within first two years after registering into the program.

### **Overview of the courses for MS and PhD Programs**

The courses will be offered on the availability of course instructors and the number of students registered for the course. The available faculty member of Mathematics works in the following field of Mathematics and offers numerous courses from these areas. With reference to the field of specialization of the current PhD faculty members that department has, we offer four different tracks of specializations for MS and PhD. The details of elective courses of each specialization are given below:

STOCHASTIC ANALYSIS AND FINANCE			
S. No.	Course Code	Course Title	Credit Hours
1.	MATH-601	Discrete Time Modelling and Derivative Securities	03
2.	MATH-602	Modeling of Bonds, Term Structure, and Interest Rate Derivatives	03
3.	MATH-603	Stochastic Calculus & Black-Scholes Theory	03
4.	MATH-604	Continuous Time Finance/Market and Interest Rate Modeling	03
5.	MATH-605	Credit Risk Modeling	03
6.	MATH-606	Mathematical Methods for Finance	03
7.	MATH-607	Numerical Solution of Stochastic Differential Equations	03
8.	MATH-608	Stochastic Partial Differential Equations	03
9.	MATH-609	Actuarial Mathematics	03
10.	MATH-610	Measure and Integration	03
11.	MATH-611	Stochastic Processes	03

## Elegibility Criteria

Admission is purely merit-based and depends exclusively on the following factors:

- **Academic Eligibility**

MS/MPhil degree with a minimum CGPA 3.0 (out of 4.0 in semester system) or first division (in the annual system).

- **Performance in NTS/STS GAT General Subject**

A subject test conducted by the National Testing Service (NTS) or ETS, USA in the area of specialization chosen at the PhD level must be cleared prior to admission for the PhD Program.

- In case of GAT subject or GRE subject test, the minimum required score is 60% marks.
- In case of STS, conducted by Sukkur IBA University, the minimum required score is 70% marks.

Please see the HEC Minimum Criteria for more detail or follow the link below:

[http://hec.gov.pk/english/scholarshipsgrants/Documents/MPHIL\\_PhD\\_Criteria.pdf](http://hec.gov.pk/english/scholarshipsgrants/Documents/MPHIL_PhD_Criteria.pdf)

- **Interview Performance:**

Only shortlisted applicants on the basis of GAT (Subject) Test conducted by NTS/STS will be invited for interview.

Fluid Mechanics			
S. No.	Course Code	Course Title	Credit Hours
1.	MATH-621	Abstract Algebra	03
2.	MATH-622	Viscous Fluids	03
3.	MATH-623	Non-Newtonian Fluids	03
4.	MATH-624	Theory of Fluids	03
5.	MATH-625	Methods of Applied Mathematics	03
6.	MATH-626	Perturbation Methods	03
7.	MATH-627	Theory of Differential Equations	03

Fluid Mechanics			
S. No.	Course Code	Course Title	Credit Hours
1.	MATH-631	Theory of group actions and group graphs	03
2.	MATH-632	Homological Algebra	03
3.	MATH-633	Error Correction and Coding Theory	03
4.	MATH-634	Theory of Semigroups	03
5.	MATH-635	Universal Algebra	03
6.	MATH-636	Category Theory	03
7.	MATH-637	Inverse Semigroups: The theory of Partial Symmetries	03

Computational Fluid Dynamics			
S. No.	Course Code	Course Title	Credit Hours
1.	MATH-641	Computational Methods in Fluid Dynamics	03
2.	MATH-642	Numerical Methods for Partial Differential Equations	03
3.	MATH-643	PDE-Constraint Optimization	03
4.	MATH-644	Finite Element Methods For Turbulent Flows	03
5.	MATH-645	Transport Modelling	03

MS Thesis			
S. No.	Course Code	Course Title	Credit Hours
1.	MATH-651	MS Thesis	06

PhD Thesis			
S. No.	Course Code	Course Title	Credit Hours
1.	MATH-652	PhD Thesis	30



## List of PhD Faculty Members

Department of Mathematics has six PhD faculty members. All the PhD faculty members have different areas of specialization in Mathematics. Following is the list of PhD faculty members along with their areas of specialization.

**1. Dr. Javed Hussain Brohi - HoD Mathematics**

Areas of interest and research include, Theory of S-acts, Credit Risk and Credit Derivatives, Stochastic Geometric partial differential equation particularly stochastic partial differential equations taking values in Semi-Remannian Manifolds.

**2. Dr. Zarqa Bano - Program Coordinator MS & PhD**

Area of interests are analytical solutions of Differential Equations arising in the field of Fluid Mechanics.

**3. Dr. Sidrah Ahmed**

Areas of interest include finite element methods (Continuous and discontinuous) for nonlinear systems of partial differential equations, Finite volume methods for complex hyperbolic-parabolic conservation laws, Applications in automated software fenics and OpenFoam environment, Computational Mathematics and its applications in natural and Social Sciences.

**4. Dr. Rida e Zenab**

Area of interest include Algebra, particularly structure theory of semi groups decomposition of structures by actions. Semi group actions closely related to theoretical Computer Science.

**5. Dr. Hyder Ali Muttaqi Shah**

Area of interest is Mathematical and Numerical Modelling of the Lagrangian random walk for the transport processes in the environmental and oceanic models. More specifically, quantifying the rates and pathways of surface-to-surface transport in the global ocean.

**6. Dr. Barkat Ali Bhayo**

Area of interest includes “Geometric Function Theory (GFT)”, particularly Quasiconformal mappings, Inequalities of special functions (Hypergeometric functions, generalized elliptic integrals and modular functions, gamma function, etc), generalized (p,q)-functions, i.e, so-called generalized trigonometric functions, inequalities of lassical means, the use of ICT in Mathematics, theories of learning, Islamic Mathematics.

**7. Dr Fazeel Anwar**

Areas of research interest include Representation Theory of Algebraic Groups, Homological Algebra, Group Equations, Classification of Galois Polynomials, Combinatorial Commutative Algebra, Applications of Group Representations and Linear Algebra.

**8. Dr. Mutti Ur Rehman**

Area of interest is Numerical Analysis. More specifically, areas of interest include Stability of numerical methods for differential equations, Matrix Nearness Problems, Matrix Computation, Stability, and Instability analysis of feedback systems in the linear control theory.

**9. Dr. Siddiqua Mazhar**

The fundamental area of my research interest is in Group Theory, particularly in combinatorial and computational aspects of group theory. Currently I am interested in practical development of algorithms in group theory.



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