Professor Payer Ahmed Ph.D.

Contact Information

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0.1 Personal Information

Name : DR. PAYER AHMED (as in passport)

Present Affiliation :**Payer Ahmed Ph.D.**
Professor
Department of Mathematics
Ex. Dean
Faculty of Science
Jagannath University, Dhaka, Bangladesh.

.**Father's Name** : Late RanguMiah

Mother's Name :Chandraban Begum
Date of Birth : 1 January 1967
Permanent Address : Village+P.O.-Lakshmipur, Union-14 No. Alkara,
Thana- Chouddagram, District- Comilla.Bangladesh.
Sex & Marital Status : Male, Married
Present Address : B-5 (4th Floor), 46 Shamonti, Shantinagar, Dhaka-1216.

Efficiency in Language:

Language	Speaking	Writing	Reading
English (taken IELTS)	Outstanding	Outstanding	Outstanding
Bangla	Excellent	Excellent	Excellent
Arabic	Excellent	Good	Excellent
Japanese	Moderate	Good	Good
Urdu	Good	Poor	Poor

0.2 Areas of Teaching & Research Interests: ANALYSIS, DYNAMICAL SYSTEMS

Dynamical Systems: *Chaos Theory, Fractal, Mandelbrot & Julia Sets, Population Dynamics, Applications of Chaos Theory in Natural and Other Sciences), Computational Mathematics.*

Analysis: *Functional Analysis, Topology, Measure Theory, Fundamentals of Mathematics, Advanced Calculus, Real & Complex Analysis, Linear Algebra, etc.*

Interest in Physics: *Various phenomena in natural science are described in terms of mathematical analysis such as dynamical systems and differential equations and they are studied by means of the most advanced methods in Real Analysis, Complex Analysis, Topology, Functional Analysis, and so on.*

More Interests: *Differential Equation, Numerical Analysis, Fluid Dynamics, Theory of Relativity, Semiconductor Physics (Quantum Material Science), Mathematical Statistics, Probability and Statistical Modeling, Basic Statistics, Bio-Statistics.*

An Interest in Undergraduate Level:

To establish a mathematical equation that can change the world, I would like to emphasize the knowledge of Vast Mathematical Worlds which may be divided into Seven Worlds of Mathematics. The worlds can be designated as History of Mathematics (HM), Application of Mathematics (AM), Beauty of Mathematics (BM), Enjoyment of Mathematics (EM), Scare of Mathematics (SM) or Math Phobia, Teaching of Mathematics (TM), Knowledge of Mathematics (KM) and Research of Mathematics (RM). From these spectacular worlds, one can learn a lot of things about mathematical universe. By HM, AM, BM, EM, SM, TM, KM& RM one can know the historical background of mathematics and mathematicians with their invaluable contributions, application of mathematics in visible and tangible world, all spectacularly beautiful images (Fractal World) generated by mathematical techniques, presentation of even very complicated mathematical problem in a very simplified and ingenuous way, way of dispelling mathematical scares by making the subject interesting and playful, methodology of mathematics teaching in an innovative, ingenious, easily communicative, way of finding all basic knowledge of mathematics with huge instances& friendly way and way to scale the new heights of success in global research respectively (so that a researcher will come out with such an equation reflecting his profound erudition and monumental achievement that will turn around the conception of mathematics in the whole world which means a very consequential turning point in the transformation of the society).

1. Essential Background

1.1 Education

Degrees	Years	Institutions	Course Works
Ph. D.	**2002**	Graduate School of Science and Engineering, Department of Mathematical Sciences, Faculty of Science, **Yamagata University, Japan.**	**Ph.D. Thesis:** Analysis of Chaotic Dynamical Systems **Additional Courses:** **(i)** Advanced Lectures on Complexity Analysis **(ii)** Advanced Lectures on Complex Analysis **(iii)** Advanced Lectures on Analysis of Chaotic Dynamical Systems **(iv)** Advanced Lectures on Harmonic Analysis **(v)** Advanced Lectures on Transformation Groups. **Additional Works** **(vi)** Advanced Seminar **(vii)** Advanced Field Research **(viii)** Advanced Practice Teaching **(ix)** Research Proposal **(x)** Planning of Ph.D. Thesis.
M.Phil. (**Master of Philosophy**)	**1992**	Department of Mathematics, Bangladesh University of Engineering and Technology (**BUET**), Dhaka, Bangladesh.	**Applied Mathematics:** Fluid Mechanics, Differential Equation.
M.Sc.	**1988**, Result Published: **1992**	Department of Mathematics, University of Chittagong, Bangladesh.	**Applied Mathematics:** Fluid Mechanics, Theory of Relativity, Thermodynamics and Statistical Analysis, Dynamic Meteorology, Classical Mechanics.
B. Sc. (Honors)	**1987**, Result Published: **1990**	Department of Mathematics, University of Chittagong, Bangladesh.	**Higher Mathematics:** Numerical Analysis, Differential Equation, Higher Algebra, Higher Trigonometry, Differential and Integral Calculus, Set Theory, Abstract Algebra, Mechanics (Statics and Dynamics), Linear Algebra, Electricity, Real Analysis, Complex

			Analysis, Vector Analysis. Subsidiary Subjects: Physics, Statistics
H.S.C.	**1984**	Chittagong GovernmentCollege, Chittagong, Bangladesh.	Compulsory English & Bengali, Physics, Chemistry, Higher Mathematics, Biology.
S.S.C.	**1982**	Gunabati Multilateral High School, Comilla, Bangladesh.	Compulsory English & Bengali, General Mathematics, Higher Mathematics, Physics, Chemistry, Biology, Islamiat .

1.2 Course Works: All Courses taken at Ph.D., M. Phil., M. Sc., B. Sc. (Honors) levels already stated in the last column of Section 1.1

1.3 Awards &Achievements

Awards:

- '**Post-Doctoral Research Fellowship'** by the Japanese Government **(2008).**
- **'Monbusho/Monbukagetsu Scholarship'** by the Japanese Govt. for Ph.D. Program **(1998 – 2002).**
- '**Gold Medal'by Japanese Government & Rotary Club International, Japan (2002).**
- '**Gold Medal'by BCZS** for **1st position** in theM.Sc. Final Examination **(1992).**
- **Teaching Assistantship(T.A)** awarded by the Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan **(1999 – 2002).**
- **Merit Scholarship by BUET** (Bangladesh University of Engineering & Technology) for getting selection in M. Phil. (Master of Philosophy) Program (1993-1994) program.
- **'BikkhuShilasarSasri Scholarship'for becoming University Top Brilliant Student of the Year1992'**by the Chittagong University authority.
- **Undergraduate, College, Secondary& Primary Merit Scholarships** (1987-1988, 1984,1982).

Achievements/Academic Results:

- Job as a **University Teacher** at Jagannath University, Dhaka, Bangladesh
- Job as a **B.C.S** (Bangladesh Civil Service) General Education Cadre Officer (resigned for Univ. Job) by the Ministry of Education, Government of the People's Republic of Bangladesh.
- Obtained **Grade A⁺** (80-100)% with full units (16 unit) in specialized all Ph.D. Courses
- **FIRST CLASS (FIRST POSITION)** in the M.Sc.Final Examination.
- **FIRST POSITION**in the B.Sc.(Hons) Final Examination.
- **FIRST DIVISION** with Distinction in **H.S.C (**Higher Secondary Certificate) Final Examination
- **FIRST DIVISION** with Distinction in **S.S.C** (Secondary School Certificate) Final Examination.

1.4 Skills in Computing

- MICROSOFT WORDS, LATEX ETC.
- MATHEMATICA
- FORTRAN
- MATLAB
- SCENTIFIC WORKPLACES AND SCIENTIFIC WORDS

2. Teaching Career

2.1 Teaching Summary

I started my teaching career as Bangladesh Civil Service (B.C.S) Education Cadre Officer in Lecturer position in November 1993 just after the obtaining of my M.Sc. degree in 1992. I taught many courses at 11 Universities and University Colleges in my country and outside of my country **including Jagannath University, Manarat International University, International Islamic University, Dhaka Campus, Ahsanullah University of Science and Technology, Yamagata University, Japan** etc.

I have been teaching many core courses of **Applied and Pure Mathematics** for the last 21 years. The coursesinclude*Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics), Computational Mathematics (Mathematical Finance, Mathematical Modeling in Biology), Functional Analysis, Topology, Measure Theory, Differential Equation, Numerical Analysis, Fluid Dynamics, Advanced Calculus, Fourier Analysis, Real Analysis, Complex Analysis, Linear Algebra, Basic Mathematics (Higher Algebra, Higher Trigonometry), Set Theory, Abstract Algebra, Mechanics (Statics and Dynamics), Vector Analysis, Basic Statistics etc.*

I am also ready to teach any course of mathematics with or without packages. I had been always maintained the synchrony between lectures, labs, home works, returning graded home works and quizzes, covering of materials and exams.

2.2 Employment History (29 November 1993 to till date)

1.

- **Positions and Affiliations:***Professor*, Department of Mathematics, Jagannath University, Dhaka, Bangladesh.
- **Period:**26 April 2012 to till date
- **Courses Taught:** Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics), Chaos Theory with their Real Life Applications, Mathematical Modeling in Biology, Computational & Discrete Mathematics, Functional Analysis, Topology, Measure Theory, Differential Equations, Numerical Analysis, Fourier Analysis, Real & Complex Analysis.
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Main Responsibilities:** Teaching & Research Mathematics and Others (Pl. see 'Duties & Responsibilities' for details).
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2.

- **Positions and Affiliations:***Associate Professor and Chairman*, Department of Mathematics, Jagannath University, Dhaka, Bangladesh.
- **Period:**8 January 2005 to 19 March 2012.
- **Courses Taught:** Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications, Mathematical Modeling in Biology, Computational & Discrete Mathematics, Functional Analysis, Topology, Elementary Calculus with Applications, Real & Complex Analysis, Statics & Dynamics with Applications, Linear Algebra with Applications.
- **Programming Taught:**MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Main Responsibilities:** Teaching & Research Mathematics, Others (Pl. see 'Duties & Responsibilities' for details).

3.

- **Positions and Affiliations:***Associate Professor and Postdoctoral Research Fellow*, Department of Mathematics, Yamagata University, Japan, Bangladesh.
- **Period:**24 September 2008 to 24 December 2008.
- **Research Subjects:**Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications, Computational & Discrete Mathematics, Functional Analysis & Topology, Euclidean, Banach& Hilbert Spaces, History of Mathematics, Operator Theory, Quantum Solid State Physics, Computer Simulations, Linux & Cryptography.
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Main Responsibilities:** Research Mathematics and Mathematical Physics, Attending the Conference, Seminar etc.

4.

- **Positions and Affiliations:***Lecturer*, Department of Mathematics, Jagannath University, Dhaka, Bangladesh.
- Period: 23 March 2004 to 7 January 2005.
- **Courses Taught:** Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications, Differential & Integral Calculus with Applications, Real & Complex Analysis, Mathematical Methods & Vector Analysis, Higher Algebra & Trigonometry, Linear Algebra with Applications, Geometry of Two and Three Dimensions, Set Theory & Abstract Algebra, College Algebra, Trigonometry with Discrete Mathematics (Statistics included).
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCENTIFIC WORKPLACE.
- **Main Responsibilities:** Teaching & Research Mathematics, Others (Pl. see 'Duties & Responsibilities' for details).

5.

- **Positions and Affiliations:***Lecturer,* Eden Government University College, Dhaka, Bangladesh.
- **Period:**12 February 2004 to 22 March 2004.
- **Courses Taught:** Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications, Differential & Integral Calculus with Applications, Real & Complex Analysis, Mathematical Methods & Vector Analysis, Higher Algebra & Trigonometry, Linear Algebra with Applications, Geometry of Two and Three Dimensions, Set Theory & Abstract Algebra, College Algebra, Trigonometry with Discrete Mathematics (Statistics included).
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Main Responsibilities:** Teaching & Research Mathematics, Others (Pl. see 'Duties & Responsibilities' for details).

6.

- **Positions and Affiliations:***Lecturer,*Government Tolaram University College, Narayangong, Bangladesh.
- Period: 18 July 2002 to 11 February 2004.
- **Courses Taught:** Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications, Differential & Integral Calculus with Applications, Real & Complex Analysis, Mathematical Methods & Vector Analysis, Higher Algebra & Trigonometry, Linear Algebra with Applications, Geometry of Two and Three Dimensions, Set Theory & Abstract Algebra, College Algebra, Trigonometry with Discrete Mathematics (Statistics included).
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.

- **Main Responsibilities:** Teaching & Research Mathematics, Others (Pl. see 'Duties & Responsibilities' for details).

7.

- **Positions and Affiliations:***Lecturer*, Secondary and Higher Education Directorate, Dhaka, Bangladesh.
- Period: 1 April 2002 to 17 July 2002.
- **Courses Taught:** Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications, Differential & Integral Calculus with Applications, Real & Complex Analysis, Mathematical Methods & Vector Analysis, Higher Algebra & Trigonometry, Linear Algebra with Applications, Geometry of Two and Three Dimensions, Set Theory & Abstract Algebra, College Algebra, Trigonometry with Discrete Mathematics (Statistics included).
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Main Responsibilities:** Teaching & Research Mathematics, Others (Pl. see 'Duties & Responsibilities' for details).

8.

- **Positions and Affiliations:***Ph.D. Researcher and Teaching Assistant*, Department of Mathematical Sciences,Faculty of Science, Yamagata University, Japan.
- Period: 13 October1998 to 31 March 2002.
- **Courses Taught:** Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications, Advanced Lectures on Complexity Analysis, Advanced Lectures on Complex Analysis, Advanced Lectures on Analysis of Chaotic Dynamical Systems, Advanced Lectures on Harmonic Analysis, Advanced Lectures on Transformation Groups, Advanced Seminar, Advanced Field Research, Advanced Practice Teaching, Research Proposal, Planning of Dr. Thesis, Elementary Calculus with Applications, Topology, Functional Analysis, Differential Equations with Applications.
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Main Responsibilities:** Ph.D. Research and Teaching Assistantship.

9.

- **Positions and Affiliations:***Lecturer,*Barishal Government Women College, Barishal, Bangladesh.
- Period: 29 November 1993 to 11 July 1994.
- **Courses Taught:** Differential & Integral Calculus with Applications, Real & Complex Analysis, Mathematical Methods & Vector Analysis, Higher Algebra & Trigonometry, Linear Algebra with Applications, Geometry of Two and Three Dimensions, Set Theory & Abstract Algebra, College Algebra, Trigonometry with Discrete Mathematics (Statistics included).
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Main Responsibilities:** Teaching & Research Mathematics, Others (Pl. see 'Duties & Responsibilities' for details).

 Service and Experiences at Private and Foreign University:

10.

- **Positions and Affiliations:***Professor*, Department of Arts and Sciences, Ahsanullah University of Science and Technology, Tejgaon, Dhaka, Bangladesh

- **Period:**June 2014 to till date.
- **Level:** M.Sc.
- **Courses Taught:** Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Responsibility:** Teaching & Research Mathematics.

11.

- **Positions and Affiliations:***Professor*, Department of Arts and Sciences, Ahsanullah University of Science and Technology, Tejgaon, Dhaka, Bangladesh
- **Period:**Jan 2015 to till date.
- **Level:** Undergraduate and Graduate
- **Courses Taught:** Matrix, Vector Algebra, Fourier Analysis and Fourier Transforms and its uses in solving Boundary Value Problems (to the Computer Science and Engineering Students), Ordinary and Partial Differential Equations (to the Electronics and Electrical Engineering Students).
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Responsibility:** Teaching & Research Mathematics.

12.

- **Positions and Affiliations:***Professor*, Department of (1) Computer Science & Engineering (2) Electronics & Electrical Engineering (3) Pharmacy, Manarat International University, Mirpur Campus, Dhaka, Bangladesh
- **Period:**June 2014 to till date.
- **Level:** Graduate
- **Courses Taught:** Statistics & Probability (Frequency Distribution of Data-Population & Sample, Mean, Median, Mode, Geometric Mean, Weighted Average, Harmonic Mean, Variance, Moments, Skew & Kurtosis, Correlation Theory, Linear & Nonlinear Regression, Least Square Method of Curve Fitting, Probability & it's theories, Discrete & Continuous Random Variables, Mathematical Expression, Conditional Probability, Probability Distribution-Binomial, Poisson & Normal Distribution-their Applications, Introduction to Stochastic Process & Applications), Integral & Differential Calculus, Geometry of Two and Three Dimensions.
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Responsibility:** Teaching Mathematics & Statistics.

13.

- **Positions and Affiliations:***Associate Professor*, Manarat International University, Gulshan, Dhaka, Bangladesh ,
- **Period:**January 2012.
- **Level:** Bachelor of Business Administration (BBA) Graduate
- **Courses Taught:** Business Mathematics
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Responsibility:** Teaching Mathematics & Statistics.

14.

- **Positions and Affiliations:** *Professor,* Department of Arts and Sciences, Ahsanullah University of Science and Technology, Tejgaon, Dhaka, Bangladesh
- **Period:** October 2012.
- **Level:** Graduate (M.Sc. & EEE students)
- Courses Taught: Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications, Applications of Mathematics to Science and Technology (Engineering Students)
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Responsibility:** Teaching & Research Mathematics.

15.

- **Positions and Affiliations:** *Associate Professor*, Manarat International University, Gulshan, Dhaka, Bangladesh ,
- **Period:** January 2012.
- **Level:** Bachelor of Business Administration (BBA)
- **Courses Taught:** Business Mathematics
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Responsibility:** Teaching Mathematics & Statistics.

16.

- **Positions and Affiliations:** *Associate Professor*, International Islamic University, Dhaka Campus, Bangladesh.
- **Period:** 1998-1999.
- **Level:** Bachelor of Business Administration (BBA)
- **Courses Taught:** Business Mathematics
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- Responsibility: Teaching Mathematics & Statistics.

17.

- **Positions and Affiliations:** *Teaching Assistant (T.A),* Department of Mathematical Sciences, Faculty of Science, **Yamagata University, Japan.**
- **Period:** 13 October1998 to 31 March 2002. Conducted Courses: Dynamical Systems (Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics) with Applications, Advanced Lectures on Complexity Analysis, Advanced Lectures on Complex Analysis, Advanced Lectures on Analysis of Chaotic Dynamical Systems, Advanced Lectures on Harmonic Analysis, Advanced Lectures on Transformation Groups, Advanced Seminar, Advanced Field Research, Advanced Practice Teaching, Research Proposal, Planning of Dr. Thesis, Elementary Calculus with Applications, Topology, Functional Analysis, Differential Equations with Applications.
- **Programming Taught:** MATHEMATICA, MATLAB, FOURTRAN, LATEX, SCIENTIFIC WORKPLACE.
- **Main Responsibilities:** Conducted T.A related works with Ph.D. Supervisor..

2.3 Major Duties & Responsibilities: During my long teaching and research career, my common activities included-

- planning, developing and implementing a curriculum as approved by the Department of Mathematics ;

- teaching students based on mathematical principles in a manner that is within their ability to comprehend, assisting student learning, answering questions and working one-to-one basis with students;
- preparing, administering and marking student assignments and examinations;
- advising students regarding course and academic matters;
- supervising graduate students (M.Sc., M. Phil. & Ph.D.);
- conducting research studies and publishing findings and theoretical & professional perspectives ;
- analyzing and evaluating subject information to determine course requirements ;
- organizing and coordinating curriculum and course schedules ;
- advising students regarding academic requirements and options ;
- serving on committees concerned with curriculum revision, academic planning, degree requirements, faculty matters ;
- participating in university governance ;
- representing the university as Speaker, Guest Professor, Consultant and Resource Person ;
- participating in research projects and keeping abreast of current changes in mathematical theory or teaching practices ;
- traveling to various universities, conferences and professional development seminars ;
- networking and interacting with other mathematics Professors around the world.

2.4 Areas of Teaching Excellence & Expertise

Areas of teaching excellence include ***Dynamical Systems, Chaotic Dynamical Systems, Applications of Chaos Theory in Natural and Other Sciences, Population Dynamics, Mathematical Modeling in Biology, Fractal Geometry, Mandelbrot & Julia Sets, Mathematical Statistics & Bio-Statistics, Functional Analysis, Topology, Measure Theory, Differential Equations, Numerical Analysis),Computer Science & Engineering Mathematics, Electronics & Electrical Engineering Mathematics, Business Mathematics (BBA & MBA), Mathematical Physics, Real & Complex Analysis, Elementary & Higher Mathematics (Advanced Calculus, Linear Algebra, Higher Algebra & Trigonometry, Vector & Tensor Analysis etc.)***

M.Sc., M. Phil. (Master of Philosophy) & Ph.D. Level:*Dynamical Systems*, *Chaotic Dynamical Systems, Applications of Chaos Theory in Natural and Other Sciences, Population Dynamics, Mathematical Modeling in Biology, Fractal Geometry, Mandelbrot & Julia Sets, Measure Theory etc.*

B.Sc.(Honors)/Undergraduate Level:*Functional Analysis, Topology, Differential Equations, Numerical Analysis, Computer Science & Engineering Mathematics, Electronics & Electrical Engineering Mathematics, Business Mathematics (BBA & MBA), Mathematical Physics, Mathematical Statistics, Probability Density Functions & Bio-Statistics, Real & Complex Analysis Elementary & Higher Mathematics (Advanced Calculus, Linear Algebra, Higher Algebra & Trigonometry, Vector & Tensor Analysis) etc.*

2.5 Current Teaching Assignments

M.Sc., M. Phil. (Master of Philosophy) & Ph.D. Level:*Dynamical Systems& Chaotic Dynamical Systems, Applications of Chaos Theory in Natural and Other Sciences, Population Dynamics, Mathematical Modeling in Biology, Fractal Geometry, Mandelbrot & Julia Sets.*

B.Sc.(Honors)/Undergraduate Level:*Functional Analysis, Topology, Differential Equations, Numerical Analysis, Fourier Analysis, Real & Complex Analysis, Advanced Calculus, Linear Algebra, Basic Algebra, Vector Analysis etc.*

2.6 Statement of Courses Taught [As per Syllabus of the department]

Course No. and Title of the Courses Taught	Levels	No. of Students (approx.)	Hours Per Week (approx.)	Year
MTH-6414: Dynamical Systems & its Applications	Postgraduate M. Phil & Ph.D.	20	8	2014-15
MTH-5106,5206: Dynamical Systems with Applications	Graduate M.Sc.	60 (average)	6	2002 to till date
MTHT-4102: Topology MTHT-4201: Functional Analysis MTHT-4103: Methods of Applied Mathematics (not taken every year) MTHT-4104: Partial Differential Equations (not taken every year) MTHT-4105: Linear Programming (not taken every year) MTHT-4107: Discrete Mathematics (not taken every year) MTHT-4205: Mathematical Modeling in Biology (not taken every year) MTHT-4210: Honors Project (not taken every year) MTHT-4211: Math Lab (not taken every year)	Undergraduate B.Sc. (Honors): 7-8 Semesters	80 (average) 9 (for projects)	8	2002 to till date

MTHT-3102, 3202: Real Analysis I+II MTHT-3103: Complex Analysis MTHT-3104: Ordinary Differential Equations (not taken every year) MTHT-3105: Numerical Analysis (not taken every year) MTHT-3106: Mechanics I (not taken every year) MTHT-3205: Methods of Applied Mathematics (not taken every year) MTHT-3206: FORTRAN PROGRAMMING (not taken every year)	Undergraduate B.Sc. (Honors): 5-6 Semester	90 (average)	6	1993 to till date
MTHT-2102, 2201: Calculus & Advanced Calculus MTHT-2103, 2202: Linear Algebra MTHT-2204: Mathematica Lab (not taken every year)	Undergraduate B.Sc. (Honors) : 3-4 Semesters	90 (average)	8	1993 to till date
MTHT-1201, 1102: Basic Algebra MTHT-1102, 1202: Calculus MTHT-1103, 1203: Two & Three Dimensional Vector Geometry (not taken every year) MTHT-1101: Fundamentals of Mathematics	Undergraduate B.Sc. (Honors) : 1-2 Semesters	90 (average)	10	1993 to till date

At Different Private Universities: MTH-503: Dynamical Systems MATH-1203: Vector, Matrix & Fourier Analysis MATH-2201 : Ordinary & Partial Differential Equations MATH-101: Calculus & Co-Ordinate Geometry STS-301: Statistics & Probability	Graduate & Undergraduate **Programs:** MS, CSE, EEE, STAT, BBA, MBA	50 (average)	9	2008 to till date (not taken every year)

2.7. Teaching Philosophy & Methodology

My philosophy in teaching is to inspire students as **William Arthur Ward stated** "*The mediocre teacher tells. The good teacher explains. The superior teacher demonstrates. The great inspires*".

Mathematics is the mother of science and a tool of scientific and technological efflorescence. It has been a demanding subject across disciplines. Numerous research Centre and companies have always been searching for graduates in computational mathematics, first to absorb and then to train them to suit their requirements. As a mathematics instructor, one attempts to reinforce the analytical and problem-solving skills to a broad range of academic areas. In all subject contents and other educational endeavors, the applications of basic mathematical principles, deduction, and the scientific method militates the disciplined-reasoning abilities that one strives to develop.

Since I started my academic career as a teacher of mathematics, my goal has been to become an effective teacher with a positive attitude towards students and colleagues. The substantive indication of the students from the student evaluation reports demonstrate that my teaching is on the right track. This longstanding evidence has been a continuous source of encouragement that keeps me moving forward on the road to be an efficient teacher. My interaction with my teachers during my student life, and now my interaction with students as an instructor have both helped me to rediscover the knowledge of the subject and enthusiasm for teaching.

Students need to be encouraged to ask questions. They need to receive genuine appreciation for their ideas, talents, and learning abilities. My experience has shown that prompt feedback, participation during their individual and group projects, flexibility in setting individual and group requirements, fair evaluation and grading, all help to a large extent to motivate them to meet their individual and group objectives. These in turn help me to meet my objective of being an efficient and effective teacher.

On a continuous basis, my students contribute a lot to make me understand their needs and my own limitations as their facilitator in the learning process. Another reason for my dedication towards excellence in academia is my keen interest in research publications and books. I have enjoyed my teaching profession over the years by being able to teach. Hopefully, one day I will perfect my teaching techniques and will become an "ideal" teacher.

I usually present course materials by uploading these on WebCT. I follow the content of the text book, enriching them by some annotations from my personal notes and efficiently integrating it while lecturing through the smart classroom facilities. I organize my lecture notes in three ways. For service courses in mathematics, I concentrate to calculus and prefer to explain rationale behind mathematical theories for a wide

spectrum of students. Emphasis is given on the understanding of real world phenomena, the formulation of mathematical methods by using intuitive arguments and thereby making meaningful decisions.

Lecture notes are typed up, projected on the screen and then explained during every lecture. They are organized in a way that motivates students. In service courses, I start to motivate students with an easy problem and in so doing the underlying theory is exposed. Students actively take part in the process of formulation of the theory.

Some typical questions that may help students understand the material are projected on the screen and explained with reference to the particular section of the lecture material or the particular formula being employed. At the end of every chapter, I encourage students to solve some typical questions prepared as Practice Problems, uploaded on WebCT or Blackboard, projected on the screen and explained in the class.

In certain courses, I give instructions to the students in the use of **Mathematica, Fortran, Matlab etc**. while teaching computational mathematics. I believe it helps students to read outputs from mathematical packages.

I have always been attempting to improve my service to students. Invariably the course schedule is distributed on the first day of the course. I always offer a minimum of 5 office hours per week, maintain an open door policy and encourage students to contact me at any time during working days. I encourage them to ask questions by telephone or email.

The decision to base grades on computerized marking of multiple-choice questions is very detrimental. Thus, I like to do the marking of answer sheets myself so that I can know the level of my students after completion of the first mid-term exam. I then try to reach their level. To be fair with the students, I always mark one question at a time for all the exam booklets which reduces some sort of bias in marking, let alone the managerial time per exam booklet. Moreover, I set a broad range of questions, which requires putting ideas together to solve.

Teaching Style in the Classroom

Mathematics is one of the subjects that almost everyone dreads. Students have lot of anxiety about the subject and most of the time they start the course with fear, disappointment and nervousness. However, it is the instructor's responsibility to make sure that the course is taught in an easy to understand language and make it fun. Below are some of the ways I apply so that these can make the mathematics class very fun and interesting and will increase student participation.

Encouragement: On the first day of the class, I encourage the students to learn the particular course by explaining its importance by a simple example drawn from their area of concentration of study and making a connection between the two. I tell students that the class will be an entertaining one. Also I assure students that I will do my best to make the concepts easy to understand with interesting examples and exercise. This helps student develop a passion for learning. I also encourage them to carry a laptop or other multimedia devices where lecture materials are downloaded, calculator, pencil, eraser, ruler and most importantly a school-bag with them.

Importance: I tell students the importance of the subject and why they should work hard in a disciplined manner to learn. I provide the reference that the use of mathematics can be found in almost every newspaper, magazines and other media outlets. I tell that understanding mathematics on different media will ensure their success in their personal life. The subject will create a skill in using information around him to take right decisions in the face of uncertainty in their professional life.

Motivation and Discovery: I try to motivate students by a real world example that is close to their life, say to their cars, computers, fridges, mobile phones etc. I pose a problem. Instead of solving the problem, I try to brainstorm the solution based on their past background and further motivation, helping a little by little, formulate the problem, and together we discover a well known formula. The joy of excitement and team work will leave impeccable impression in their mind. They will enjoy solving problems with that formula. It will be part of their life, rather than a formula imposed on to them, or rotten by them without interest.

Accommodation:I discovered through my experience that while learning a subject students strive to add on their existing knowledge. This requires a special care of knowing and accommodating their background in order to help facilitate learning. For example, in teaching probability theory, some may prefer Venn diagram for showing a sample space while others may like tree diagram, tabular representation or set theoretic representation. Similarly a flow chart of concepts or stages of an experiment, a mesh, lattice work or trellis diagram may facilitate learning for many.

Two Innovative Methods: While preparing lecture notes or power point presentations, I use a method "Simplification Through Colors (STC)". The part of a mathematical equation in a line that needs to be simplified is colored. In the following line its simplified version is also represented by the same color. The use of different colors for different simplification problems make the material visually pleasing, much more readable and easily understood. I also use another method "Engagement Through Filling in Activity (ETFA). My lecture notes or tutorials have blank spaces to be filled in by understanding the material during lectures or tutorials. Students feel special eagerness to improve his or her own note.

Package: I prepare the lecture notes in some electronic format. I upload them in the Blackboard or WebCT. I also prepare home works in a way that contains problems that can be solved by the skills achieved during lecture, problems that need to put ideas together, and problems that are a bit challenging. I also set the other exams keeping in mind the outcome of learning.

Presentation: Sometimes, I give them the assignment of picking an article from Newspapers, Magazines or other academic journals that has mathematical problem and ask to present their finding in the class via a short 10 minute presentation. This provides them an opportunity to pick their favorite article and discuss their finding with the class. I also sometimes provide Lab Projects.

Interaction: I allow students to interact. I wander around the room so that shy students can also pass comments when I am closer to him or her. Their comments help me assess where they stand with respect to the content. Often I need to move back and prepare them for moving forward through an example or recapitulating the material.

Humor: I tell stories and jokes about mathematics. If there are interesting videos about mathematics, I show them during the class.

Software Package: I try to teach basic course in a lab. Ideally basic math courses should be taught in a lab environment.A mathematical software / package has been essential to understanding the subject. The other alternative is the strong background in analysis. However visualization gets permanent impression on any mind.

Lifelong Learning: I try to provide the impression that by taking a course in mathematics, they did not learn everything of it, rather they started becoming a better learner of it, and it will continue. He or she may lose the teacher's lecture note but internet facilities, books and journals will be around him to enrich his or her knowledge, to help him /her to take the right decision in the face of uncertainty.

3. Research

3.1 Research Interests

Research Fields: Mathematics, Solid State Physics
Research Groups: Mathematical Systems, Quantum Materials Science
Dynamical Systems: Chaos, Fractal, Mandelbrot & Julia Sets, Population Dynamics**,** Applications of Chaos Theory in Natural and Other Sciences), Computational Mathematics, Functional Analysis, Topology, Measure Theory,Fundamentals of Mathematics, Advanced Calculus, Real & Complex Analysis, Linear Algebra,etc.

Various phenomena in natural science are described in terms of mathematical analysis such as dynamical systems and differential equations and they are studied by means of the most advanced methods in real analysis, complex analysis, functional analysis, and so on.

More Interests: Differential Equation, Numerical Analysis, Fluid Dynamics, Theory of Relativity, Semiconductor Physics (Quantum Material Science), Mathematical Statistics, Probability and Statistical Modeling,Basic Statistics, Bio-Statistics.

SpecialInterests:

(1) Payer Math Eight Worlds (PM8W): To establish a mathematical equation that can change the world, I would like to emphasize the knowledge of Vast Mathematical Worlds which may be divided into Seven Worlds of Mathematics. The worlds can be designated as History of Mathematics (HM), Application of Mathematics (AM), Beauty of Mathematics (BM), Enjoyment of Mathematics (EM), Scare of Mathematics (SM) or Math Phobia, Teaching of Mathematics (TM), Knowledge of Mathematics (KM) and Research of Mathematics (RM). From these spectacular worlds, one can learn a lot of things about mathematical universe. By HM, AM, BM, EM, SM, TM, KM& RM one can know the historical background of mathematics and mathematicians with their invaluable contributions, application of mathematics in visible and tangible world, all spectacularly beautiful images (Fractal World) generated by mathematical techniques, presentation of even very complicated mathematical problem in a very simplified and ingenuous way, way of dispelling mathematical scares by making the subject interesting and playful, methodology of mathematics teaching in an innovative, ingenious, easily communicative, way of finding all basic knowledge of mathematics with huge instances& friendly way and way to scale the new heights of success in global research respectively (so that a researcher will come out with such an equation reflecting his profound erudition and monumental achievement that will turn around the conception of mathematics in the whole world which means a very consequential turning point in the transformation of the society).

(2) Scientific Approach Towards Understanding Quran: Some books on this site is in preparation.

3.2. Ph.D. at a Glance:

Subject Specialized	:Mathematics
Major Field	:Dynamical Systems
Division	: Graduate School of Science and Engineering
Doctoral Thesis	:*Analysis of Chaotic Dynamical Systems*
Ph.D. Supervisor	: **Professor Dr. Shinzo Kawamura**

Emeritus Professor, Department of Mathematical Science,
Faculty of Science, Yamagata University, Japan.

Specialized Courses Taken in Ph.D.:

- Advanced Lectures on Complexity Analysis
- Advanced Lectures on Complex Analysis
- Advanced Lectures on Analysis of Chaotic Dynamical Systems
- Advanced Lectures on Harmonic Analysis
- Advanced Seminar
- Advanced Field Research
- Advanced Practice Teaching
- Advanced Lectures on Transformation Groups
- Research Proposal
- Planning of Dr. Thesis

3.3. Research Activities in Mathematics

3.3.1. Introduction: *Dynamical Systems, Chaos, Iteration, Fractal, Mandelbrot and Julia Sets* represent popular and exciting fields of mathematics developed in recent decades and accessible to school-age students and present in contemporary mathematics curricula.

We give special emphasis on **Chaotic Dynamical Systems**. We study properties of chaotic maps by a view point of Functional Analysis and derive mathematical theory concerning chaotic dynamical systems.

Various phenomena in natural science are described in terms of mathematical analysis such as dynamical systems and differential equations and they are studied by means of the most advanced methods in Real Analysis, Complex Analysis, Topology, Functional Analysis, and so on.

Applications of Chaos Theory in Real Life:

A model that determines the evolution of a system given only by the initial state is called a dynamical system. Now-a-days Dynamical Systemsrepresents a very much popular research topic and immense contribute in the field of mathematics.

Much of what happens in the nature can be modeled by mathematical equations. For years, scientists have been developing mathematical equations from the motion of the simple pendulum to the motion of the planets in the solar system.

Upon hearing the word chaos, one's mind usually conjectures a place of total disorder and confusion. This is the usual meaning of the word in normal usage. However, there has been a literal explosion of scientific interest in chaos and how to control it or at least understand it. If the term chaos really implied total disorder or randomness, there would probably be no point in studying the phenomenon. However, in technical literature, the term chaos means something that appears to be random and disordered but is actually deterministic in nature, meaning that it is precisely controlled by natural laws. The apparent disorder arises from an extreme sensitivity to initial conditions, much like the path of the ball in a pinball machine seeming to defy human control. This paper discusses the scientific meaning of the word chaos and how understanding chaos may be of great benefit to mankind.

Though Chaos Theory was born from observing weather patterns, but it has become applicable to a variety of other situations. Some areas benefiting from chaos theory are *Mathematics, Physics, Chemistry, Computer Science, Biology, Microbiology, Engineering, Geology, Population Dynamics, Economics, Finance, Algorithmic Trading, Meteorology, Philosophy, Psychology, Robotics, Politics etc.*

Chaos theory is not new to **Computer Science** and has been used for many years in **Cryptography**. One type of encryption, secret key or symmetric key relies on **diffusion and confusion** which is modeled well by chaos theory. Another type of computing, **DNA computing** when paired with chaos theory, offers a more efficient way to encrypt images and other information.

Robotics is another area that has recently benefited from chaos theory. Instead of robots acting in a trial-and-error type of refinement to interact with their environment, chaos theory has been used to build a **Predictive Model**.

For over a hundred years, biologists have been keeping track of populations of different species with **Population Models.** Most models are deterministic systems, but recently scientists have been able to implement chaotic models in certain populations. For example, a study on models of **Canadian lynx** showed there was chaotic behavior in the population growth.

Chaos can also be found in **Ecological Systems,** such as **Hydrology.** While a chaotic model for hydrology has its shortcomings, there is still much to be learned from looking at the data through the lens of chaos theory.

Another **Biological Application** is found in **Cardiograph.** Fetal surveillance is a delicate balance of obtaining accurate information while being as noninvasive as possible. Better models of warning signs of **fetal hypoxia** can be obtained through chaotic modeling.

In **Chemistry**, predicting gas solubility is essential to manufacturing **polymers,** but models using **Particle Swarm Optimization(PSO)** tend to converge to the wrong points. An improved version of PSO has been created by introducing chaos, which keeps the simulations from getting stuck.

In **Celestial Mechanics**, especially when observing asteroids, applying chaos theory leads to better predictions about when these objects will come in range of Earth and other planet.

In **Quantum Physics** and **Electrical Engineering,** the study of large arrays of **Josephson Junctions** benefitted greatly from chaos theory. Closer to home, coal mines have always been dangerous places where frequent natural gas leaks cause many deaths. Until recently, there was no reliable way to predict when they would occur. But these gas leaks have chaotic tendencies that, when properly modeled, can be predicted fairly accurately.

Chaos theory can be applied outside of the natural sciences. By adapting a model of career counseling to include a chaotic interpretation of the relationship between employees and the job market, better suggestions can be made to people struggling with **career decisions.** Modern organizations are increasingly seen as open complex adaptive systems, with fundamental natural nonlinear structures, subject to internal and external forces which may be sources of chaos. The **chaos metaphor**—used in verbal theories—grounded on mathematical models and psychological aspects of human behavior provides helpful insights to describing the complexity of small work groups that go beyond the metaphor itself.

It is possible that **Economic Models** can also be improved through an application of chaos theory, but predicting the health of an economic system and what factors influence it most is an extremely complex task. Economic and financial systems are fundamentally different from those in the physical and natural sciences since the former are inherently stochastic in nature, as they result from the interactions of people, and thus pure deterministic models are unlikely to provide accurate representations of the data. The empirical literature that tests for chaos in economics and finance presents very mixed results, in part due to confusion between specific tests for chaos and more general tests for non-linear relationships.

Traffic forecasting is another area that greatly benefits from applications of chaos theory. Better predictions of when traffic will occur would allow measures to be taken for it to be dispersed before the traffic starts, rather than after. Combining chaos theory principles with a few other methods has led to a more accurate short-term prediction model (see the plot of the BML traffic model at right).

Chaos theory also finds applications in **Psychology.** For example, in modeling group behavior in which heterogeneous members may behave as if sharing to different degrees what in **Wilfred Bion's** theory is a basic assumption, the group dynamics is the result of the individual dynamics of the members: each individual reproduces the group dynamics in a different scale, and the chaotic behavior of the group is reflected in each member.

Some of the areas studied using chaos theory are**Fluid and Atmospheric Dynamics,** plankton growth and migration, ionization of excited atoms or molecules, and human nerve signals.

A Japanese company produced a **dishwasher** whose water jets moved chaotically by Nomura, Wakami and Kondo, 1995.

Chaos theory is a set of mathematical tools that helps numerically explore phenomena that are very complex in reality. For example, the **<u>Poincare map</u>**can help you characterize and identify the allowed periodic trajectories in a system such as the double pendulum (or ionizing of Hydrogen, or any chaotic system). Such observations can help guide a wide range of experiments.

3.3.2. Some Research Outlines: In the following, I give some outlines of my research concerning chaotic dynamical systems.

1. Chaotic homeomorphism of compact subspace of real line: Chaotic homeomorphism is concerned with compact subspaces of real line equipped with standard topology.A continuous map of a compact space into itself is said to be chaotic if it satisfies the three conditions (Robert L. Devaney, *An Introduction of Chaotic Dynamical Systems, Second Edition,* **Addition-Wesley, 1989, section 1.8, Definition 8.5**]. We know a lot of chaotic maps on those continuous maps. As typical examples, there exist tent map on the unit interval and unilateral shift maps on the Cantor set. We prove that there exists a chaotic homeomorphism of compact spaceonto itself if and only if the said spaceis homeomorphic to the Cantor set [**P. Ahmed, S. Kawamura**, Chaotic homeomorphisms of the compact subspace of real line, *Bull. of Yamagata University, Japan, Nat. Sci.***Vol.16, No.4, Feb. 2008 127-133].** We show a family of chaotic homeomorphism of the Cantor set onto itself [**P. Ahmed, M. Rahman, S. Kawamura** , Relationship among compact subspaces of real line and their chaotic properties**,** *International Journal of Pure and Applied Sciences and Technology***, Vol.6,No.1,pp.62-70,September(2011)**]. W. Melo and S. Strien [*one-dimensional dynamics*, Ergebnisse Math. IhrerGrenzgebiete, 3.Folge . Band 25, Springer Verlag, 1993] have had a lot of detailed discussion on the behavior of orbits for one-dimensional dynamics [**P. Ahmed, S. Islam**, Chaotic behaviour in dynamical systems of homeomorphism on the unit interval, *Journal ofBangladesh Academy of Sciences..***Vol. 32, No. 2, 131-139, 2008]**. In contrast to it, we discuss on it from the point of view of chaotic property in the sense of R. L. Devaney.

2. Chaotic Maps on Measure Space and Perron-Frobenius Operator: We study a linear operator in a Banach Lattice which is similar to the Perron-Frobenius operator in L^1 **-**space associated with n Laps (**MWnL**). Our attention is to the properties of chaotic maps on a measure space called **MWnL** by observing the behavior of the orbits of probability density functions on compact space. This study was extended to the case of states of a Von Neumann algebra on a Hilbert space associated with the measure space [**P. Ahmed, J. Islam and S. Kawamura**, Chaotic maps on measure space and the behaviour of orbits of states, *International Journal of Mathematics and Computer Applications Research (IJMCAR), Vol.1, Issue.1(2011) 19-36*]. The results were simple convergence theorems in contrast with the chaotic three conditions and thus gave another view point concerning chaotic maps.

We show the behavior of the orbit of a positive unit vector with respect to the iteration of the said linear operator. Our main result is to give two subspaces ofthe said Banach Lattice and satisfy a convergence property. Applying these results in a Banach Lattice, we give above subspaces in L^1-space corresponding to various chaotic maps. We study the behavior of the orbit of probability density function. We unify the convergence theorem by S. Kawamura (**Tokyo J. Math. 24(2) (2001), 509-533**) into the theory of convergence in Banach Lattice. Namely, we establish convergence theorem concerning the orbit of a vector with respect to the iteration of a linear operator on a Banach Lattice [**P. Ahmed, S. Kawamura, S. Sasaki**, Banach Lattices & the Perron-Frobenius Operator Associated with Chaotic Map, *Far East Journal of Dynamical Systems* **8(1) (2006),1-25**].

Future Plan on Perron-Frobenius Operator: We are now interested to study higher dimensional chaotic maps such as Hennon map, Baker map (two-dimensional maps) and Lorenz map (three-dimensional) and Perron-Frobenius Operator associated with these higher dimensional chaotic maps.

2. Generalized Chain Rule for Schwarzian Derivatives and its Dynamical Behavior: We analyze the behavior of Schwarzian Derivatives of analytic function and Chain Rule for Schwarzian derivatives. We

generalized the Chain Rule for Schwarzian derivatives with the dynamical behavior of negative Schwarzian derivatives. [**P. Ahmed, J. Islam,** Generalized chain rule for Schwarzian Derivatives and its Behavior, *International Journal of Pure and Applied Sciences and Technology"*, **Vol. 6, No. 1, pp. 71-79, September(2011)**].

3. Orbit Analysis of Newton's Iteration Function Associated To Real Function: Here we discuss the chaotic behavior of orbits of Newton iteration function associated to real functions and established mathematical theorem concerning chaotic dynamical systems. **[P. Ahmed, J. Islam, S. Islam, 'Orbit Analysis Newton Iteration Function Associated to Real Functions'** published in the **'Scottish Journal of Arts, Social Sciences and Scientific Studies', Vol. 22, Issue II Oct. 2014, ISSN 2047-1278 (http://scottishjournal.co.uk)**.

4. Fractal Geometry *[Another Interesting Tool of Dynamical Activities]* **:**Many people are fascinated by the beautiful images termed as *fractals*. Extending beyond the typical perception of mathematics as a body of complicated, boring formulas, fractal geometry mixes art with mathematics to demonstrate that equations are more than just a collection of numbers. What makes fractals even more interesting is that they are the best existing mathematical descriptions of many natural forms, such as *Coastlines, Mountains, Fractal Fern, Koch Curve, Fractal Trees, Flowers etc.***or parts of living organisms.**

We have generated some known and unknown fractals like *Mandelbrot Set,* **Cantor middle-third sets,** *Sierpinski Triangle, Fractal Fern, Koch Curve, Fractal Trees, Flowers etc.* Our attention is to show their dynamical behavior considering some generating functions with suitable iteration rules and initial seeds so that we can eventually know the fate of the orbits of those seeds under the iteration rules.

5. Research on Cantor Sets:

Special emphasis is given to Cantor Sets that plays an important role in many branches of Mathematics, and is not just an artificial construct, especially designed to exhibits the possible pathologies that can raise the systematic development of real analysis. The Cantor ternary expansion is used in Measure Theory.

As it is well known that Cantor sets were discovered by the German Mathematician George Cantor in the late 19th to early 20th centuries (1845-1918). He introduced **Fractal** which has come to be known as the Cantor set, or Cantor dust. Cantor set is known as Cantor middle-third set in the unit interval of real line. This Cantor middle-third function can be defined from the generalized form of tent map and it is chaotic in the sense of R. L. Devaney as tent map is chaotic in this sense. It is very important to note here that nobody found Cantor middle $\{(2m-1)^{-1} : 2 \le m < \infty\}$ sets in [0, 1] earlier. In our paper "*Generalized Cantor set and its fractal dimension*", **Bangladesh J. Sci. Ind. Res. Vol. 46(4) (2011), 499-506,** we are for the first time had generalized these sets and shown their fractal dimensions. Later as a continuation of the said paper, we had formularized these sets of functions and shown their dynamical behaviors **[J. Islam, P. Ahmed, S. Islam, Formularization of Generalized Cantor Set and its Dynamical Behaviors,** *International Journal of Advanced Research and Technology. Vol. 1(7) (2012), 1-6].* Now we are trying to show their chaotic behaviors. After that, we will show that how these chaotic maps will be changed by Perron-Frobenius Operator associated with the said chaotic maps. More exactly, we will show the behavior of orbits of Perron-Frobenius operator associated with Chaotic Cantor Maps. In this case, it is important to find probability density function or density of the probabilistic invariant measure of the said Chaotic Cantor Maps so that we can predict the fate of the orbits of Perron-Frobenius Operator.

6. Mandelbrot and Julia Sets [Another Tool of Dynamical Activities]: *Mandelbrot and Julia Sets* introduces a marvelous new area of mathematics developed in recent decades. We have generated some known and unknown fractals like *Mandelbrot and Julia Sets* called famous fractals. Our attention is to show their dynamical behavior considering some generating functions with suitable iteration rules and initial seeds so that we can eventually know the fate of the orbits of those seeds under the iteration rules.

In the very beginning we introduce two ways to visualize orbits, time series analysis, graphical iterations, the critical orbit, various fixed points, techniques of finding cycles geometrically, iteration rule involves complex numbers, linear complex iteration, geometry of linear iteration, fate of complex orbits, the concept of a filled Julia sets in the case of the very special iteration rule.We see that this iteration rule leads to the fascinating geometric images known as the Mandelbrot and Julia sets. We discuss the fractal nature of the Julia set by generating some beautiful shapes such as **Julia set, Fractal Rabbit, Dragon Curve, Fractal Dust and Explosions** etc. We present some of the mathematics behind one of the most intricate and interesting shapes in dynamics, the Mandelbrot set. We learn how to explore using the computer as a tool. We also generate the Mandelbrot set, **Mandelbrot antenna**, differentiate the Mandelbrot set from the Julia set, antenna, junction point, bulb and its geometry, etc. We continue the study of the Mandelbrot set with something more facts about the fascinating geometry of this set. Along the way here we see the **Fibonacci sequence** and find both rational and irrational numbers on the graph of the Mandelbrot set. We tried to generate more interesting beautiful images from the idea we got in the previous.

7. Research on Population Dynamics: Under my supervision, a mathematical analysis of the population of Bangladesh for a certain period of time (1971-2011) is carried out based on an ordinary differential equation known as Verhulst Logistic Differential Equation Model in terms of carrying capacity. The parameter and consequent growth rate are assume to be constant. We used mathematica and Matlab programs based on the algorithm of 6th order Taylor scheme. We analyzed the census data comparing with logistic model. For numerical solution we used 6th order Taylor scheme where growth rate was considered as a function of time. First we analyzed the data for Belgium, USA and France and we found our projection was a very good agreement with the actual data. Then we used the same method to project population for the aforementioned period of Bangladesh. We observed that our data for the same period of time fitted with a very good agreement with the census data. We compared our data with other researchers Rabbani ["Population Projection of Bangladesh"] and Solima ["Population Projection in Bangladesh Based on Logistic Differential Equation Model"] and found that our data worked with very good agreement than that of their data.

Now we are working to analyze and predict the population growths using Finite elements method especially spectral method.

3.3.3. Main Research Themes:

Various phenomena in natural science are described in terms of mathematical analysis such as dynamical systems and differential equations and they are studied by means of the most advanced methods in real analysis, complex analysis, functional analysis, and so on.

- The study of properties of chaotic maps by a point of view of Functional Analysis.
- Chaotic homeomorphisms of the compact subspace of real line.
- Chaotic Maps on Measure Space and Perron-Frobenius Operator.
- Orbit Analysis of Newton's Iteration Function Associated to Chaotic Functions.
- Formularization of Generalized Cantor Set and its Dynamical Behaviors.
- Chaotic maps on measure space and the behaviour of orbits of states.
- Relationship among compact subspaces of real line.
- Chaotic conditions in compact subspaces and redundancy in the definitions of chaos.
- Generalized Chain Rule for Schwarzian Derivatives and its Dynamical Behavior.
- The Perron-Frobenius Operator and the Behavior of Orbits of Probability Density Function.
- Generalization of bifurcations in one-dimensional maps with applications.
- Numerical Analysis for Thermal Design of a Paraboloidal Solar Concentrating Collector.
- GAMMA VECTOR SPACES AND THEIR GENERALIZATIONS**.**
- Chaotic behaviour in dynamical systems of homeomorphism in unit interval

- Banach Lattices & the Perron-Frobenius Operator Associated with Chaotic Maps.
- Chaotic homeomorphisms in one-dimensional dynamics.
- Chaos in mathematics and the behavior of orbits of probability density functions.
- Chaotic Maps and Banach Lattice.
- Chaotic homeomorphisms of compact subspace of real line and a kind of chaotic homeomorphism.
- The behaviour of orbits of points in the dynamical systems defined by homeomorphism on unit interval.
- Dynamical Behavior of Fractal Geometry
- Generating beautiful images by considering suitable generating functions
- Dynamical Behavior of Mandelbrot & Julia Sets
- Dynamical Behavior of One and Two-Dimensional Maps
- Logistic Model with its Real Life Applications
- Applications of Chaos Theory in Natural and Other Sciences
- Development of stable algorithms using spectral methods and numerical simulations for nonlinear physical phenomena.

3.4. Research in Mathematical Physics based on Differential Equations

Theme: *Computer Simulations of Physical Phenomena using Transport and Diffusion Equations in Solid.*

Topic: *Development of stable algorithms using spectral methods and numerical simulations for nonlinear physical phenomena.*

Outline:

Study on Spectral Methods: It is known that finite difference methods and finite element methods are the main two technologies for the numerical solution of partial differential equations such as diffusion and transport equations. But from 1970's, spectral method has been studied and developed by many researchers of various fields, which has become the third main technology used in scientific computing. We want to develop algorithms based on spectral method for diffusion and transport equations.

Numerical Studies on the Physical Phenomena: Numerical simulations for the above physical phenomena are difficult to solve because of special physical conditions such as nonlinear and/or non-equilibrium conditions. For such phenomena, we want to perform numerical simulations using the spectral method.

Interesting Phenomena in Solids:

(1) Transient thermoelectric effect in semiconductors Si (silicon), GaAs (gallinium arsenide) and so on.
(2) Anomalous Hall Effect in superpramagnetic phase of environmental semiconductor $FeSi_2$.
(3) Transient Giant Nernst effect in environmental semiconductor $FeSi_2$.

The above phenomena have not been understood yet because they are nonlinear and non-equilibrium phenomena and thus cannot be treated analytically. In the present systems, however, there exist huge number of charged particles. Thus it is necessary to study these phenomena by using computer technology.

Purpose: We study spectral methods which can be applicable to the computer simulations for several physical nonlinear or non-equilibrium phenomena related basically to the transport and diffusion phenomena. It is known that finite difference methods and finite element methods are the main two technologies for the numerical solution of partial differential equations such as diffusion and transport equations. We develop algorithms based on spectral method for diffusion and transport equations.

We have focused on the following nonlinear and/or non-equilibrium phenomena and we have studied these phenomena by using computer simulation techniques:

- Transient Thermoelectric Effect (**TTE**) in semiconductors **Si**, **GaAs**, and so on. It is the transient nonlinear and non-equilibrium phenomena. Nobody except QMS group has studied these phenomena because of special technique.

- Transient Giant Nernst effect in environmental semiconductor $FeSi_2$. This result is very recent interesting one and shows quite unusual behavior under magnetic field.
- Anomalous Hall effect in superpramagnetic phase of environmental semiconductor. If we have enough time, we can get some new results from this phenomenon.

Results may be obtained:

- *We can obtain suitable spectral methods applicable to nonlinear and non-equilibrium phenomena.*
- *We can understand the basic features of the results of TTE experiments as transient phenomena related to carrier transport and diffusion of the charged particles.*
- *We can obtain the key clue on Transient Giant Nernst Effect observed experimentally.*
- *Our results give important computer technology in solid state physics which can be applicable in basic behavior of plasma in galaxy.*

An Experiment: "Growth mechanism of silver wire" (both experimental and numerical)**:** On the growth mechanism of silver wire, experimental works have done and computer simulation of growth mechanism of silver wire is ongoing.

3.5. Research Collaborations

Mathematics Research Group:

1. **Professor Dr. Xindge Dai,** Department of Mathematics and Statistics, **North Carolina University, Charlotte, USA**, an expert of Wavelets Theory and Dynamical Systems.
2. **Professor Dr. WieslawKrawcewicz,** Department of Mathematics, **Alberta University, Edmonton, Canada,** an expert of Dynamical Systems.
3. **Professor Dr. Shinzo Kawamura,** Department of Mathematical Sciences, Faculty of Science, **Yamagata University, Japan**, an expert of Operator Algebra and Dynamical Systems.
4. **Professor Dr. Uchiyama**, Department of Mathematical Sciences, Faculty of Science, **Yamagata University, Japan**, an expert of Operator Algebra and Analysis..
5. **T. Amano, M. Jahir Ahmed**, Advanced Industrial Science and Technology (AIST), **Tsukuba, Japan.**
6. **Professor Dr. Shahidul Islam, Ph.D.**, Professor, Dept. of Mathematics, Faculty of Science, **University of Dhaka**, Dhaka, Bangladesh.

Mathematical Physics Research Group:

1. **Professor Dr. Minoru Sasaki, Ph.D**, Department of Physics, Faculty of Science, Yamagata University, Japan (Expert of Solid State Physics, Low Temperature Physics, Mathematical Physics).
2. **Dr. Payer Ahmed, Ph.D.**, Associate Professor and Chairman, Department of Mathematics, Faculty of Science, Jagannath University, Dhaka, Bangladesh.
3. **Professor Dr. Akimasa Ohnishi**, **Ph.D**, Department of Physics, Faculty of Science, Yamagata University, Japan, Ph.D. in Engineering (Expert of Solid State Physics).
4. **Dr. M. Kitaura**,**Ph.D** Department of Physics, Faculty of Science, Yamagata University, Japan (Expert of Solid State Physics).
5. **Dr. M. Ajiki**,**Ph.D,** Department of Physics, Faculty of Science, Yamagata University, Japan, Ph.D. in Engineering (Expert of Solid State Physics).
6. **Professor Dr. Qing Fang, Ph.D,** Department of Mathematical (Applied) Sciences, Faculty of Science, Yamagata University, Japan, (Expert of Applied Mathematics: Numerical Analysis, Information Mathematics, Discrete Mathematics and Computer Programming).
7. **Prof. Dr. KamrulAlam Khan**, **Ph.D,** Department of Physics and Dean, Faculty of Science, Jagannath University, Dhaka, Bangladesh.
8. **Prof. Dr. P. Bala**, **Ph.D,** Department of Physics, Faculty of Science, Jagannath University, Dhaka, Bangladesh.

3.6. Some Selected Publications

1. **Shah Abdullah Al Nahian, Md. Zakir Hosen, Payer Ahmed,** An elementary Study of Chaotic Behaviors in 1-D Maps, *Journal of Applied Mathematics & Physics, 2019,7,1149-1173, ISSN Online: 2327-4379, Print: 2327-4352.*

2. **Shah Abdullah Al Nahian, Md. Zakir Hossen, Payer Ahmed,** Dynamics of One Dimensional Mouse Map, *Int. J. Adv. Appl. Math & Mech, 6(4)(2019) 32-40, ISSN: 2347-2529.*

3. **Md. Ashraful Islam, Payer Ahmed,** Dynamical Behavior of Logistic Map for Different Parameter Values, *International Journal of Sciences: Basic & Applied Research (IJSBAR), ISSN:2307-4531, Vol. 36, No.5, pp 238-253, 2018.*

4. **Md. Zakir Hosen, Md. Mohiuddin Zillu, Payer Ahmed,**Several Chaotic Approaches of One Dimensional Doubling Map,*American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS) ISSN (Print) 2313-4410, ISSN (Online) 2313-4402, 2018.*

5. **RITA AKTER, PAYER AHMED,** Some Real Life Applications of Dynamical Systems: *IRE Journals,Volume 2, Issue 7, ISSN: 2456-8880, Jan. 2019.*

6. **Md. Nurujjaman, Ahammed Hossain, Dr. Payer Ahmed**, "A Review of Fractal Properties: Mathematical Approach", *Science Journal of Applied Mathematics & Statistics: 2017; 5(3): 98-105.*

7. **Md. Shakhawat Alam, Dr. Payer Ahmed**, " Lots of Chaotic Behaviors of He'non Map," *ESJ: European Scientific Journal; ISSN: 1857 - 7881 (Print), ISSN: 1857 - 7431 (Online), VOL 12, NO 36 (2016)*http://eujournal.org/index.php/esj/issue/view/259

8. **Ahammed Hossain, Md. Nurujjaman, , Dr. Payer Ahmed,** Fractals Generating Techniques, *Sonargaon University Journal*, Vol 1, Number 1, December 2016.

9. **2. Md. Shakhawat Alam, Dr. Payer Ahmed**, "Several Chaotic Analysis in Lorenz Systems," *ESJ: European Scientific Journal; ISSN: 1857 - 7881 (Print), ISSN: 1857 - 7431 (Online), 2016* **(Accepted).**

10. *J.* **Islam, P. Ahmed S. Islam,** Orbit Analysis of Newton's Iteration Function Associated To Chaotic Functions, *Scottish Journal of Arts, Social Sciences and Scientific Studies*, *Vol. 22, Issue II (Oct. 2014), 96-108.*

11. **J. Islam, P. Ahmed, S. Islam,** Formularization of Generalized Cantor Set and its Dynamical Behaviors**, *International Journal of Advanced Research and Technology. Vol. 1(7) (2012), 1-6].*

12. **P. Ahmed, J. Islam and S. Kawamura**, Chaotic maps on measure space and the behaviour of orbits of states, *International Journal of Mathematics and Computer Applications Research (IJMCAR), Vol.1, Issue.1(2011) 19-36.*

13. *P.* **Ahmed, M. Rahman, S. Kawamura** , Relationship among compact subspaces of real line and their chaotic properties**, *International Journal of Pure and Applied Sciences and Technology, Vol. 6, No. 1, pp. 62-70, September(2011).*

14. *P.* **Ahmed**, **J. Islam, S. Kawamura,** Chaotic conditions in compact subspaces and redundancy in the definitions of chaos, *International Journal of Mathematics and Computer Applications Research (IJMCAR), Vol.1, Issue.1(2011) 1-18.*

15. **P. Ahmed, J. Islam,** Generalized chain rule for Schwarzian Derivatives and its Behavior, *International Journal of Pure and Applied Sciences and Technology"*, Vol. 6, No. 1, pp. 71-79, September(2011).

16. *P.* **Ahmed, J. Islam, S. Islam,** The Perron-Frobenius Operator and the Behavior of Orbits of Probability Density Function, *Jagannath University Journal of Science (JNUSci.), Vol. 1, No. 1, pp. 27-34 (2011) .*

17. *J.* **Islam, P. Ahmed, S. Islam,** Generalization of bifurcations in one dimensional maps with applications, *Jagannath University Journal of Science (JNUSci.), Vol. 1, No. 1, pp. 43-54 (2011).*

18. *A.* **H. Rubel, P. Ahmed, M. Rahman, K. Khan,** Numerical Analysis for Thermal Design of a Paraboloidal Solar Concentrating Collector**, *International Journal of Natural Sciences (iJNS), (2011), 1(3) 68-74.*

19. *SaburUddin,* **P. Ahmed,** GAMMA VECTOR SPACES AND THEIR GENERALIZATION**, *International Archive of Applied Science and Technology, (IAAST) Vol. 2 [2] December 2011: 77-83.*

20. *P.* **Ahmed, S. Kawamura**, Chaotic homeomorphisms of the compact subspace of real line, *Bull. of Yamagata University, Japan, Nat. Sci. Vol.16, No.4, Feb. 2008 127-133.*

21. *P.* **Ahmed, S. Islam**, Chaotic behaviour in dynamical systems of homeomorphism on unit interval, *Journal of Bangladesh Academy of Sciences.. Vol. 32, No. 2, 131-139, 2008.*

22. **P. Ahmed, S. Kawamura, S. Sasaki**, Banach Lattices & the Perron-Frobenius Operator Associated with Chaotic Map, *Far East Journal of Dynamical Systems* 8(1) (2006),1-25.

23. **P. Ahmed**, Chaotic homeomorphisms in one-dimensional dynamics, *Journal of Science, Iwate , Japan, May 5-6, P. 1-4, 2001.*
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26. **P. Ahmed and S. Kawamura**, Chaotic homeomorphisms of compact subspace of real line and a kind of chaotic homeomorphism, *ICAMMP, SUST, Jan.6-9, 2003, p. 285-287***.**
27. **P. Ahmed**, The behaviour of orbits of points in the dynamical systems defined by homeomorphism on the unit interval, *ICAMMP, Sept. 11-15, 2000, 67-70.*

Thesis and Books:

28. **P. Ahmed**, Analysis of Chaotic Dynamical Systems, *Doctoral Thesis P. 1-84 (2002). Yamagata University, Japan.*
29. **P. Ahmed, J. Islam,** *Dynamical Systems with its Graphical Representations, April (2012).*
30. **P. Ahmed, Elementary Calculus,** 2010.
31. **P. Ahmed, Basic Real Analysis,** 2012.
32. **P. Ahmed, Basic Functional Analysis,** 2012.
33. **P. Ahmed, Basic Topology,** *2012.*
34. **P. Ahmed, DewanQuddus**, *Linear Algebra, AngikarProkashani,2004.*
35. **Prof. Dr. Payer Ahmed,** Higher Mathematics (H.S.C), First Paper,*Published by NCTB (24.6.2013)*
36. **Prof. Dr. Payer Ahmed,** Higher Mathematics (H.S.C), Second Paper,*Published by NCTB.*

Conference Proceedings:

37. **Payer Ahmed, S. Kawamura**, Chaos in Mathematics and the behavior of orbits of probability density functions, *Proc. of Int. Conf. App. Math & Math Phys., Jan. 4-7, 2005.*
38. **P. Ahmed, S. Kawamura, S. Sasaki**, Chaotic Maps and Banach Lattice, *Proc. of Int. Conf. App. Math & Math Phys., Jan. 6-9, 2003, 277-283.*
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42. **P. Ahmed, S. Kawamura**, A kind of chaotic homeomorphism on the Cantor Sets, *Proc. of Int. Conf. App. Math & Math Phys., Sept., 2000.*

Papers already submitted and are in preparations:

43. **P. Ahmed, Xingde Dai (USA),** J. Islam, Zhongyan Li (China), *Multipliers, Phases and Connectivity of MRA Wavelets in $L^2 (R^2)$ (in preparation).*
44. **MazedurRahman , P. Ahmed**, Dynamical behavior of Fractal Geometry using Mathematica and MatLab*(already presented& in preparation).*
45. **ZakariaParves, P. Ahmed**, Dynamical behavior of Mandelbrot and Julia sets using Mathematica and Matlab*(already presented& in preparation).*
46. **Mohammad SaifurRahman, P. Ahmed**, Chaotic behavior of one-dimensional maps using Mathematica and Matlab*(already presented& in preparation).*
47. **LokmanHossain, P. Ahmed**, Dynamical behavior of one-dimensional maps using Mathematica and Matlab*(already presented& in preparation).*
48. **A. M. Jahir, P. Ahmed, T. Amano, Mo Sasaki, Y. Miamoto, K. Komori, M. Mori, T. Shimuzu,** Ridge mesa stripe quantum dot laser fabrication and characteristics of low threshold by using GaAs*(manuscript prepared).*

3.7. Attended Conferences, Seminars & Workshops

- **6th National Undergraduate Mathematics Olympiad-2014** by Bangladesh Mathematical Society, University of Dhaka, Bangladesh.
- **18th International Conferenceon Mathematics and Mathematical Physics** by Bangladesh Mathematical Society, Organised by Independent University Of Bangladesh, Gulshan, Dhaka, 2013.
- **Seminar onHeat Transfer on Fluid Flow**, Department of Mathematics, Jagannath University, Dhaka, 2012.
- **Seminar onApplications of Mathematics in Real Life**, Dept. of Mathematics, Jagannath University, Dhaka, 2012.
- **16th International Conference on Mathematics and Mathematical Physics** by Bangladesh Mathematical Society, Organised by Jahangirnagar University, Sabar, Dhaka, 22-24 December 2011.
- **16th International Conferenceon Mathematics and Mathematical Physics** by Bangladesh Mathematical Society, Organised by Bangladesh University of Engineering and Technology (BUET), Dhaka, 18-20 December, 2009.
- **First Mathematics Seminar on Dynamical Systems**, Dept. of Mathematics, Jagannath University, Dhaka, 2008.
- **Seminar onElectricity Generations by PKL**, Department of Physics, Jagannath University, Dhaka, 2008.
- **14th Mathematics Conference** by Bangladesh Mathematical Society, University of Dhaka, 2003.
- **International Conferenceon Applied Mathematics and Mathematical Physics**, Shahjalal University of Science and Technology, Sylhet, Bangladesh, 2000.
- **Workshopon Chaotic Dynamical Systems and the Structure of Operators**, Iwate University, **Japan, 2001.**
- **Workshopon Chaotic Dynamical Systems**, Dhaka University, Bangladesh, 2000.
- **Workshopon Chaotic Dynamical Systems and Operator Algebra**, Research Institute of Mathematics and Physics, Chittagong University, Bangladesh, 2000.
- **Workshopon Chaotic Dynamics**, Department of Mathematics, Chittagong University, Bangladesh, 2000.
- **Pusan-YamagataFriendship Seminar of Mathematics**, Department of Mathematical Sciences, Yamagata University, **Japan, 2000.**
- **International Conferenceon Applied Mathematics and Mathematical Physics**, Shahjalal University of Science and Technology, Sylhet, Bangladesh, 2002.
-

3.8. Ph.D., M. Phil, M.Sc. & B.Sc. Student's Thesis Supervisions

Ph.D. Students (2013):
1. **M.Phil. Awarded Students (2017): Shakhawat Hossain**, Department of Mathematics, World University, Dhaka, Bangladesh, **Topic:** Chaos in Higher Dimensional Maps, **Enrollment:** June 2014 **(Degree Awarded in June, 2017).**

M. Sc. Thesis Students (2014):
2. **Md. Sharif Ullah**, **Topic:** Population Dynamics, **Enrollment:** April 2014 (**graduated).**
3. **Md. Abdul Hakim,Topic:** Dynamical Behavior of Mandelbrot & Julia Sets, **Enrollment:** April 2014 **(graduated).**
4. **Miss RumaAkter,Topic:** Fractal Geometry, **Enrollment:** April 2014 **(graduated).**

M. Sc. Thesis Students:
5. Md. Zakir Hossain: **Topic: Chaotic Behavior of One Dimensional Maps with Applications, 2016 (graduated)**
6. Md. Habibur Rahman: **Topic: Generating Fractals with Mathematical Approach,2016 (graduated)**
7. Roksana Yasmin: **Topic: Mandelbrot & Julia Sets Generating Techniques, 2016 (graduated)**
8. Rita Akter: **Topic: Fractal Geometry in Nature, 2015 (graduated)**

9. Rita Akter: **Topic: Fractal Geometry in Nature, 2015 (graduated)**
10. Ahmed Hossain, **Topic:Mathematical Approach of Fractal Geometry,** 2015 **(graduated)**
11. Md. Ashraful Islam, **Topic: Population Dynamics, 2015(graduated)**
12. Mrs. KakolyNasrin, **Topic**: **Applications of Dynamical Systems, 2015 (graduated)**
13. Md. Nuruzzaman, **Topic: Measuring Fractals, 2014 (graduated)**
14. Mrs. RakhiAkter, **Topic: Natural Phenomena of Fractal, 2014 (graduated)**
15. RejinaAkterRia: **Topic: Population Dynamics, 2014 (graduated)**
16. MriytunjoySarker, **Topic:Applications of Dynamical Systems from Nature, 2013(graduated).**
17. Nipa Rani Paul, **Topic:Graphical Representations of Fractal Geometry with, 2013 (graduated).**
18. DebashisBiswas,**Topic:Dynamical Activities without Programming, 2013(graduated).**
19. JhumurSikder,**Topic:Population Dynamics, 2013(graduated)**
20. Md. MazedurRahman, **Topic:DynamicalBehavior of Fractal Geometry, 2012 (graduated).**
21. Md. ZakariaParvez,**Topic:DynamicalBehavior of Mandelbrot and Julia Sets**, 2012 **(graduated).**
22. Md. LokmanHossain, **Topic:Dynamical Behavior Linear Maps, 2012 (graduated).**
23. JesminAkter,**opic:Dynamical Behavior Non-Linear Maps, 2012 (graduated).**

Undergraduate Research Projects:

Honors' 4ᵗʰ Batch(2010-2011):
24. Rajib Kumar BhoumiK, **Mathematical Phenomena using Differential Equations.**
25. Tapan Kumar Roy, **Latex Programming and its Applications.**
26. KhaledHasan, **Fortran Programming and its Applications.**
27. Raihan Islam, **Suitable Programming Applied to Mathematics Research**.
28. Tofail Ahmed, **Mathematica and Its Applications.**
29. ShahinAlam, **Matlab and its Applications.**

Honors' 5ᵗʰ Batch(2011-2012):: Ordinary and Partial Differential Equations
30. Kopil
31. Kingkor
32. Rubel
33. Adinath
Honors' 6ᵗʰ Batch (2012-2013):: Ordinary and Partial Differential Equations

34. Md. Nazrul Islam
35. Shuvojit Mazumder
36. Hasan Al Mahmud
37. Sharmin Akter
38. Md. Huma Hawlader
39. Motiur Rahman

Honors' 7ᵗʰ Batch (2013-2014): Techniques of Generating Fractals with Applications

40. Jannatul Ferdousy
41. Jwel Molla
42. Clement Proloy Gomage
43. Shah Abdullah Al Nahian
44. Sabina Akter
45. Abdus Salam

3.9. Proponent of a Visitor

I invited Professor my Ph.D. supervisor Prof. Shinzo Kawamura in Bangladesh for research collaboration during 2000. He gave a lecture here, and we had many research meetings with him. He discussed many problems of Dynamical Systems and Analysis.

4. Professional Development and Leadership

4.1. Membership in Professional Societies

- Member, Jagannath University Teachers Association.
- Member (Central Committee), Jagannath University Central Admission Test-2016.
- Member, Japan Mathematical Society
- Convener (Souvinir), 6th National Undergraduate Math Olympiad-2015
- Convener: Seminar on Applications of Math in Real Life (SAMRL)-2015
- Life Member, Bangladesh Mathematical Society.
- Life Member, Research Group (Quantum Material Science), Yamagata University, Japan.
- Member, Research Group (Mathematical Systems), Yamagata University, Japan.
- Member, Research Group (Mathematical Systems), Jagannath University, Dhaka.
- Secretary, JnU Math Alumni Association (JnUMAA)

4.2. Serving on Editorial Boards

I have been working as a member or as an Associate Editor of some journals. I have been actively involved in reviewing papers for these journals, maintaining liaison between authors and the editor in the process of reviewing.

- Chief, Editor, Jagannath University Journal of Science (JnUJSc.) Committee.
- Member, Editorial Board, Jagannath University Journal of Science (JnUJSc.) Committee (2012).
- Associate Editor, Jagannath University Science Journal (JnUJSc.) Committee (2012).
- Member, Editorial Board, Journal of Mathematics and Research (JMR), India.
- Member, Editorial Board, International Journal of Mathematics and Computer Research (IJMR), India.
- Member, Editorial Board, International Journal of Pure and Applied Sciences and Technology, IJPAST, India.
- Member, Editorial Board, International Journal of Applied Mathematics and Statistical Sciences (IJAMASS).
- Editorial Board Member, AR Research Publication, India

4.3 Reviewing Research Papers & Books for Journals: Reviewed many research papers for different local and international journals.

4.4. Assessment of Promotion Cases

Assessment of the promotion case from Associate to Professorship of-

1. Professor Dr. Md. RezaulKarim, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
2. Professor Dr. RobindranahMondol, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
3. Professor Dr. Md. Ayub Ali, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
4. Professor Dr. Md. Shariful Alam, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.

5. Professor Dr. Md. Mizanor Rahman, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.

Assessment of the promotion case from Assistant Professor to Associate Professorship of-

6. Dr. Md. RezaulKarim, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
7. Dr. RobindranahMondol, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
8. Dr. Md. Ayub Ali, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
9. Dr. Md. SharifulAlam, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
10. Professor Md. MizanorRahman, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
11. Dr. HanifMurad, Department of Mathematics, Noyakhali University of Science and Technology
12. Dr. SarwarAlam, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.

Assessment of the promotion case from Lecturer to Assistant Professorship of-

13. Md. SarwarAlam, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
14. Md. AlamgirHossain, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
15. Mrs. SorabanTahura, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
16. Mr. SiddarthaVoumik, Department of Mathematics, JagannathUniversity,Dhaka, Banglafesh.
17. Md. MushtakHossain, Department of Mathematics, JagannathUniversity,Dhaka, Banglafesh.
18. Mr. Nurul Huda, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
19. Mr. BishnuPadaGhosh, Dept. of Mathematics, JagannathUniversity,Dhaka, Bangladesh.
20. Mr. Abu HanifSarker, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
21. Md. ChapalHossain, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
22. Dr. SolimaKhanom, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
23. Mrs. Salina Khanom, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
24. Mrs. Rabeya Akter,Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
25. Farhana Rashid, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.

Assessment of the promotion case in Lecturer Position of-

26. Md. SarwarAlam, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
27. Md. AlamgirHossain, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
28. Mrs. SorabanTahura, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
29. Mr. SiddarthaVoumik, Department of Mathematics, JagannathUniversity,Dhaka, Banglafesh.
30. Md. MushtakHossain, Department of Mathematics, JagannathUniversity,Dhaka, Banglafesh.
31. Mr. Nurul Huda, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
32. Mr. BishnuPadaGhosh, Dept. of Mathematics, JagannathUniversity,Dhaka, Banglafesh.
33. Mr. Abu HanifSarker, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
34. Md. ChapalHossain, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
35. Dr. SolimaKhanom, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
36. Mrs. Salina Khanom, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
37. Mrs. RabeyaAkhter, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
38. Mrs. Farhana Rashid, Department of Mathematics, Jagannath University, Dhaka, Banglafesh.
39. Mrs. Goutom Kumar Das, Department of Mathematics, Jagannath University, Dhaka,
40. Md. Manik Munshi, Department of Mathematics, Jagannath University, Dhaka,
41. Miss Asia Begum, Department of Mathematics, Jagannath University, Dhaka.

4.5. University and Public Services

4.5.1 Service Philosophy

My philosophy of service is to serve as I expect to be served. Service has been the most cementing factor in creating congenial living conditions in human society. I have been actively serving in different capacities, which include advising and inspiring students. My committee works involve inside and outside the department of which one of them is to search for expert faculty.

I assisted quite a few doctoral students or employees around for understanding our subject or design research. I also serve the institution by lecturing in seminars and attending conferences. I have visited upper level high school students to inspire them in the various aspects of Mathematical thought process. My focus is to inculcate the essential importance of mathematical attitude not only for scientific research and decision making but also for raising the quality of their own living standards. I have had a great desire of training high school and colleague teachers, or teachers of other universities, employees in banks, hospital or other organizations through conducting workshops.

I have been actively involved in reviewing research papers for many journals and serving on the editorial boards as mentioned in my CV.

4.5.2   Service in the University & Departmental Committees

- Member, **Planning Committee/Tenure and Promotion/ Search Committee** for all positions (**Professor, Associate Professor, Assistant Professor, Lecturer**) of Jagannath University, all Public, Private Universities, Colleges, High Schools etc., Bangladesh. (**Assessed numerous files of job applicants applying for all positions in mathematics)**
- Member, **Board of Advanced Research and Studies** (M. Phil., Ph.D. Selection Board), Jagannath University.
- Member, **Jagannath University Academic Council** (High Powered Body of the University).
- Member, **Executive Committee** (High Powered Body of the Faculty), Faculty of Science, Jagannath University.
- Member, **Departmental Academic Committee** (High Powered Body for Faculty Selection), Department of Mathematics, Jagannath University.
- Member, **Committee of Courses/Syllabus/Textbook (Graduate and Undergraduate) Committee**, Department of Mathematics, Jagannath University, Dhaka, Bangladesh (running).
- Member, **Syllabus/Textbook (Graduate and Undergraduate) Committee**, Faculty of Science, Jagannath University, Dhaka, Bangladesh (running).
- Chair and Member, **Departmental Different Examinations** Committee (Graduate, Undergraduate)
- Member, **M.Phil and Ph.D Defense Committee**, Department of Mathematics, Jagannath University, Dhaka, Bangladesh.
- Member, Jagannath University Broadband Internet Committee (2008).
- Member, **Jagannath University Service Rules Committee** (2008).
- Member, National University **Examinations Committee** (running).
- Member and Examiner, Different Examinations Committee and Moderation Boards, National University, Dhaka University, Chittagong University, Jahangir Nagar University, Chittagong University, Rajshahi University, Shahjalal University of Science and Technology, Khulna University, Comilla University, Public Service Commission (P.S.C), Bangladesh, Private Universities.
- Member, Jagannath University **Disciplinary Committee**.
- Member, **Program Assessment Committee**, Department of Mathematics, Jagannath University.
- **Course Coordinator**(about 20 times), Department of Mathematics, Jagannath University.
- **Seminar Coordinator** (about 10 times), Department of Mathematics, Jagannath University.
- **Head, Quality Assurance Unit (QAU),** Higher Education Quality Enhancement Project (HEQEP) by World Bank.
- **Executive Member,** Entrance or Comprehensive Exams, Jagannath University.
- **Central Committee Member,** Jagannath University Admission Test

     Etc.

4.5.3. Public Service

- **Chief Adviser, Uni-Global Education Centre,** Building-1, Road-16, Sector-6, Uttara, Dhaka.
- **Adviser, International Philanthropic Society,** Building-1, Road-16, Sector-6, Uttara, Dhaka.
- **Advisor, Chouddagram Samity, Dhaka.**
- **Chairman, Gunabati High School '82 Batch Alumni Association (GHS82BAA)**

5. Professional Training

Abroad:

- **Post-Doctoral Research Fellow, Host Scientist: Emeritus Prof. Dr. Shinzo Kawamura** (Post-Doc. Supervisor), Yamagata University, Japan, **Courses Taken:** Dynamical Systems, Euclidean Spaces, 2008.

- **Teaching Assistant, Conducted Courses:** Dynamical Systems, Functional Analysis, Topology, Measure Theory and Elementary Calculus at Undergraduate and Graduate Levels, 1998-2002.

- **Ph.D. Research, Host Scientist : Emeritus Prof. Dr. Shinzo Kawamura** (Ph.D. Supervisor), Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan, 1998-2002.

- **Ph.D. Courses:** Dynamical Systems, Functional Analysis, Topology, Measure Theory and Elementary Calculus, 1998-2002**.**

- **Ph.D. Course Examiner, Host Scientist : Prof. Dr. Xingde Dai** (Ph.D. Expert), North Carolina University, USA, **Course Taken:** Wavelets Theory, 2000.

- **Quantum Materials Science Research, Host Scientist : Prof. Dr. Minoru Sasaki**, Head, **"Quantum Material Science",** Department of Physics**,** Yamagata University, Japan, **Course Taken:** Material Science related courses, 2008.
- **Computer Science Works, Host Scientist: Prof. Dr. Heideki Sawada**, Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan, **Courses Taken: C-Programming, Linux, Computational Mathematics**, **2000.**

- **Harmonic Analysis Research, Host Scientist : Prof. Dr. T. Sato**, Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan, **Course Taken: Harmonic Analysis, 2000**.

- **Complex and Complexity Analysis Research, Host Scientist : Prof. Dr. Nakada**, Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan. **Course: Complex and Complexity Analysis, 2000.**

- **Topology Research, Host Scientist : Prof. Dr. Uchida**, Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan. **Course Taken: Topology, 2001.**

- **Functional Analysis Research, Host Scientist : Prof. Dr. Okayasi**, Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan. **Course Taken: Functional Analysis, 2001.**

- **Measure Theory Research, Host Scientist : Prof. Dr. Mizuhara**, Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan. **Courses Taken: Measure Theory, 2000.**

- **Elementary Analysis Research, Host Scientist : Prof. Dr. Hirabuki**, Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan. **Courses Taken: Elementary Analysis, 2000.**

- **Transformation Groups Research, Host Scientist : Prof. Dr. Sano**, Department of Mathematical Sciences, Faculty of Science, Yamagata University, Japan. **Courses Taken: Transformation Groups, 2000.**

Home: Undertaken miscellaneous training at various stages.

6. Research Visit and Country Visited

Research Visits

- Graduate School of Science and Engineering, Yamagata university, Yamagata, Japan,1998-2002
- Graduate School of Science and Engineering, Iwata University, Japan, 2000.
- Graduate School of Science and Engineering, Waseda University, Tokyo, Japan, 2001.
- Graduate School of Science and Engineering, Tohuku University, Sendai, Japan, 2002.
- Graduate School of Science and Engineering, Kyoto University, Japan, 2008.
- Graduate School of Science and Engineering, Osaka University, Japan, 2008.

Country Visited: Japan, Thailand, Singapore, Hongkong, Philippine.

7. Ultimate Goal About Global Educational Promotion: My ultimate mission and vision for the promotion of education is to expand an innovative research environment through joint collaboration with world class scientists from home and abroad where a huge number of young, enthusiastic and indomitable researchers will work and contribute to the field of science and technology by realizing their potential through rigorous training, profound study and will evolve to invent something very new and beneficial to the whole mankind.

It is worthwhile to mention that a country needs an interactive and international standard university where young researchers will break new ground in every sphere of Arts, Sciences, Engineering and Technology and thereby push the frontiers of knowledge further to the level of human endurance. Such a university eventually will give leadership to the higher education sectors locally and internationally and will rank among the world-class universities. As a result this university will revolutionize the education system in such a way that the dissemination of new fangled technology and knowledge will benefit the whole world. Thus we envision a new world of knowledge which will turn around the fortune of people as well as will contribute to the efflorescence of human civilization.

8. References:

1. **Professor Dr. X. Dai**
   Department of Mathematics,
   North Carolina University, Charlotte, U.S.A.
   E-mail: **xdai@uncc.edu**

2. **Dr. Jahrul Alam**
   Associate Professor
   Department of Mathematics
   Memorial University of Newfoundland, Canada.
   alamj@mun.ca

- Anwarul Haque Joarder, PhD in Statistics
  (Name in Publication: Anwar H. Joarder)

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    Jahangirnagar University, Savar, Dhaka, Bangladesh.
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    E-mail:**kawamura@sci.kj.yamagata-u.ac.jp**

6. **Professor Dr. Minoru Sasaki**
    Department of Physics & Mathematical Physics, Yamagata University, Japan.
E-mail:samy-3041@io.ocn.ne.jp

(**Professor Dr. Payer Ahmed**)