Research Experience: 13 years 8 months (as on July 2017)

Selected as a Junior Research Fellow on a **Council for Scientific and Industrial Research (CSIR)** scheme and worked on *Large Amplitude Solitary Waves and Double Layer in Dusty and Astrophysical Plasma* at Department of Mathematics, Visva-Bharati (A Central University) from 19.12.2003 to 18.09.2004.

Selected as a Junior Research Fellow at Atmospheric Science Division, Meteorology & Oceanography Group, Space Applications Centre (***Indian Space Research Organisation***) and worked on *Satellite data assimilation through Numerical Models for improving Weather Prediction* from 20.09.2004 to 31.01.2006.

Completed **doctoral studies** under the supervision of **Dr. A K Shukla**, Associate Professor of Mathematics, AMHD, **SVNIT**.
Ph. D. Thesis Title: **Generalization of some Special Functions.**

Completed **post-doctoral studies** under the mentorship of **Prof. Bruce C. Berndt** at **University of Illinois at Urbana-Champaign, USA** for one year, under Indo-US research fellowship, awarded by IUSSTF, New Delhi and worked on "Bessel Function series".

Research Projects undertaken: 04

1. PI of the project "Extended Wright type Hypergeometric Functions", sanctioned by **SERB, Govt. of India,** with amount **Rs. 15,15,360/-.**(ongoing)

2. PI of the project "Data Assimilation methods in Numerical Weather Prediction", sanctioned by SVNIT (under Institute Research Grants to the Asst. Professors), sanctioned amount Rs. 10,28,000/-. **(completed)**

3. Co-PI of the project "A study on change in refractivity of the atmosphere prior to earthquake/s", sanctioned by **DST-SERB, Govt. of India,** with amount **Rs. 14,66,200/-. (completed)**

4. Co-PI of the project "Wright type Generalized Hypergeometric Functions: Inequalities and Applications" sanctioned by **CSIR, Govt. of India.** (ongoing)

Research Paper Reviewed

Reviewed several papers of the Journal like
1. Proceedings of the National Academy of Sciences, India (Section A: Physical Sciences)
2. Applied Mathematics & Information Sciences, USA
3. African Journal of Mathematics and Computer Science Research
4. Abstract and Applied Analysis.

Editorial Board Member

Editorial Board Member of **International Journal of Computational Intelligence and Mathematical Modelling.**

Research Supervision

Ph. D. Guidance: One (01) student submitted his Ph.D. thesis
Five (05) students were enrolled for Doctoral Studies

	
Jignesh P. Chauhan submitted his Ph.D. thesis on Some Aspects of Mittag-Leffler Function and Fractional Differential Equation Models.	**Rakesh L. Das** working on Inventory Problems since July 2013
	
Hiren S. Lekhadiya working on Satellite Data Assimilation **since July 2013**	**Bhumika V. Maheshwari** working on Generalized Hypergeometric Functions since July 2013
	
Radharaman Roy working on Hypergeometric Functions since December 2016	**Ankit Pal** working on Special Functions since July 2017

Guided Nine (09) students for their Master dissertation

1. Abhishek Shah: *Equivalence between 4d-Var and Kalman Filter and Comparison with an Ensemble Kalman Filter.*
2. Shivani Shreya: *An Introduction to Visual Cryptography.*
3. Hitesh Bansu: *Inventory Problems with different type of Demands.*
4. Rakesh Das: *Comparison of Firefly Algorithm with Particle Swarm Optimization and Genetic Algorithm and Solution of some Linear Programming Problems*
5. Hiren Lekhadiya: *Introduction to Different Optimization Techniques and Information Retrieval*
6. Heral Kevrani: *Hotel Inventory management using Linear Programming.*
7. Ankit Agarwal: *Some Study on Time series Analysis and Forecasting.*
8. *Hinal Solanki: Comparison of LPP and Lingo with Genetic Algorithms for Inventory Problems*
9. *Tejan Vadher: Computational Aspects of Hypergeometric Functions*

Guided Nine (09) students for Summer Internship

1. Hiren Lekhadiya completed his Summer Internship on the subject *"Information Retrieval"*.
2. Nikhil Choksi completed his Summer Internship on the subject *"Game Theory"*.
3. Divyang Gor completed his Summer Internship on the subject "*PERT and CPM"*.
4. Vidhi Patel completed her Internship on the subject "*Application of Transportation Model for deriving optimal supply route pattern for Textile Manufacturers in Surat"*.
5. Snehal Patel completed her Internship on the subject *"Introduction to Numerical Weather Prediction"*.
6. Karan Patel completed his Summer Internship on the subject *"A Study on Replacement Models"*.
7. Hinal Solanki completed her Internship on the subject *"Assignment Problems"*.
8. Rakesh Ranjan completed his Summer Internship on "*Calculus and Analytic Geometry"*.
9. *Nagesh Sahu completed his Summer Internship on "A study on Integral Transforms"*.

Research Topic

Plasma Physics

Plasma can be defined as an ionized gas, which contains charge particles. Dusty plasma can be considered as plasma co-existing with finite micron sized massive dusty charged particles. When non-linearity and dispersion of a medium balanced each other then only solitary waves formed in the medium. In plasma physics also solitary waves are the subject of considerable phenomena. Washimi and Taniuti (1966) first studied the propagation of solitary waves in simple plasma in the form of KdV equation. Study of double layers in dusty plasma is of great importance for the last three decades or so. It has an important role in space plasma, astrophysical plasma and laboratory plasma etc. Das (1979), Tran and Hirt (1974) and Das and Tagare (1975) studied the solitary waves in plasmas including multiple ionic species of different kind. All of them used Reductive Perturbative Technique (RPT), which is not suitable to study large amplitude solitary waves. Roychoudhury and Bhattacharya (1989) and Chatterjee and Roychoudhury (1994, 1995, 1997, 1999) studied different plasma models by non-perturbative technique.

Extensive numerical studies were made to obtain the double layer solution from the analytical Sagdeev's potential.

Numerical Weather Prediction

Numerical Weather Prediction (NWP) as well as the study of climate problems requires a complete and accurate description of the present state of the atmosphere and ocean. Unfortunately, no single component of the observing system measures the atmosphere and ocean with sufficient accuracy and completeness. Thus it is necessary to combine the information from different observing systems (Satellite, radiosonde, buoy, aircraft, radar etc) and from many different times to create a reasonably accurate estimate of the atmospheric and oceanic state. The information in the data is combined in space and time through a data assimilation system. Over the years, as the demand for atmospheric and environmental information grew, increasingly exotic and comprehensive observing systems were deployed for sampling atmospheric and oceanic parameters. In the northern hemisphere satellite data did not have a very strong impact on NWP. This lack of impact is due to the inability to properly incorporate the information from satellite observations into the data assimilation system.

The real time MM5 simulations were made assimilating local radiosonde observations into the model for providing the weather conditions over SHAR(Indian Satellite launch stations) during Cartosat-1 satellite launch by PSLV-C6. The evaluation of MM5 model for different cloud parameterization schemes had been studied.

Assimilation of Level-II MODIS temperature and moisture profiles in a Non-hydrostatic Mesoscale Model (MM5) had been conducted. Comparison was made between the experiments with and without MODIS profiles in MM5 initial condition. Comparison of initial state using NCEP analysis with the MODIS enhanced initial state clearly indicates the benefits of the assimilation of observed Mesoscale temperature and moisture fields.

Special Functions and Integral Transform

Modern developments in theoretical and applied science depend on the knowledge of the properties of mathematical functions, from elementary trigonometric functions to the multitude special functions. These functions appear whenever natural phenomena are studied, engineering problems were formulated, and numerical simulations are performed. The effective uses of special functions require practitioners to have ready access to a reliable collection of their properties.

The study of special functions grew up with the calculus and is consequently one of the oldest, interesting and very important branches of analysis. The generalization of special functions has proved even more useful than the separate special functions themselves. It provides a connection between seemingly unrelated functions. It can provide fresh insights into the function and thus can provide properties, or proofs, which were undiscovered till now. Extensive studies were made to generalize several special functions, mainly focusing on Mittag-Leffler function, multi dimensional special polynomials (Shivley's and Sheffer's) and Bessel Functions.

Last updated in July 2017