



**DEPARTMENT OF
MATHEMATICS
2016–2017**

ABOUT THE DEPARTMENT



DR. A. K. SAHU

M.Sc., Ph.D.

Head of the Department

Professor

Mathematics was started in the academic year 2011-2012. This course was supported by UGC under its innovative scheme and is gaining popularity. It is an inter-disciplinary programme giving practical application of mathematics and statistics in engineering, financial and biological applications. Masters students of the department were sent for an academic and industrial visit to Kolkata. The department has upgraded its computer lab by procuring MATLAB and SPSS software. The department has strong research collaborations with various institutes in India and

abroad like Indian Statistical Institute, Kolkata, University of Hyderabad, Visva Bharati University, IIT Bombay, IIT Guwahati, University of Calcutta, University of Mumbai, Arizona State University to name a few. The research activities of the faculties are being published in various peer reviewed international and national journals, conference proceedings and book chapters. Faculties are involved in organizing various national and international level educational programs related to mathematics, statistics and interdisciplinary sciences.

The Department of Mathematics ICT, Mumbai offers Master in Engineering Mathematics and Ph. D. programs. It also caters to the instructions of basic courses in Applied Mathematics for all the technology branches, Chemical Engineering and Bachelor of Pharmacy degree students of the institute. The M. Sc. programme in Engineering

FACULTY



DR. A. K. SAHU

M.Sc. (Utkal University), Ph.D. (IIT Bombay)

Head of the Department

Associate Professor

SUBJECTS TAUGHT: M.Sc. in Engineering Mathematics:

- Fluid Mechanics I

- Mathematical Biology
- Fluid Mechanics II.
- Computational Fluid Dynamics II.
- Mathematical Modeling & Designing
- Heat and Mass Transfer

RESEARCH INTERESTS:

- Computational Fluid Dynamics
- Mathematical Modeling
- Numerical Methods

PUBLICATIONS:

(peer reviewed) so far : 08

CONFERENCE

PROCEEDINGS/PAPERS: 10

SEMINARS/LECTURES/
ORATIONS DELIVERED: 14

MASTERS AWARDED AS
SINGLE/ CO-GUIDE: 1

POST GRADUATE PROJECT
SUPERVISION: 05

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT:

My basic research interest is in the field of Computational fluid dynamics (CFD), numerical methods and mathematical

modeling. In case of CFD, the thrust is giving to simulate turbulent flows for some realistic problems using latest turbulent models and numerical techniques. As it is known that for turbulent flows, the governing equations for a given problem are highly nonlinear and it is impossible to obtain an analytical solution. Therefore, the emphasis is given to use efficient numerical techniques such as: finite volume, initial value and finite difference methods to obtain the numerical solutions. Grid generation is also an important aspect of the numerical techniques and emphasis is also giving for this. Mostly for turbulent flows, the problems are chosen related to axial flow impeller, thermal

stratification in molten sodium pool, flow inside a cavity etc.

At present, it is observed that nanofluids are gaining importance in thermal engineering due to its improving thermo-physical properties such as thermal conductivity, thermal diffusivity, viscosity and convective heat transfer. Hence, its importance in forced, mixed and natural convection is being studied. It has also been observed that nanofluids have very good heat transfer enhancement properties.

MEMBERSHIP OF IN-HOUSE COMMITTEES:

UGPC and PGPC, Academic Council, MIS Committee (TEQIP-II), Steering committee of COE (TEQIP-II), Examination Committee



DR. AJIT KUMAR

M.Sc. & Ph. D. (University of Mumbai)

Associate Professor

SUBJECTS TAUGHT:

M.Sc. in Engineering Mathematics:

- Advance Calculus
- Applied Linear Algebra
- Optimization Techniques
- Software Lab- I
- Computer Programming

RESEARCH INTERESTS:

- Optimization and Statistical Techniques
- Machine Learning and Data Analytics

- Mathematical Pedagogy
- Use of Computer Aided Tools and Mathematical Software in Mathematics

PUBLICATIONS:

(peer reviewed) so far : 4

CONFERENCE

PROCEEDINGS/PAPERS: 6

BOOKS PUBLISHED: 03

BOOK (CHAPTERS)

PUBLISHED: 06

SEMINARS/LECTURES/

ORATIONS DELIVERED: 65

POST GRADUATE PROJECT
SUPERVISION: 09

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT:

My current area of interest is in the field of Optimization Techniques, Statistical Techniques, Machine Learning, Data Analytics and Mathematical Pedagogy.

Currently, two students are pursuing their Ph.D. under my guidance. One student is working in the area of vehicle routing problems and another student is working in the area of data analytics. Many students have done projects on various aspects of machine learning algorithms under my guidance some of which have resulted in conference proceedings.

Mathematical software have potential to facilitate an active approach to learning, to allow students to become involved in discovery and to consolidate their own knowledge, thus developing conceptual and geometrical understanding and a deeper approach to learning. Emergence of such mathematical tools and its ability to deal with most of the undergraduate mathematics cannot be ignored by mathematics educators. While use of computer technologies in many countries in teaching and learning mathematics have made a significant impact at all levels, use of such tools in mathematics teaching at all levels is in its infancy in India. So much so, that many mathematics teachers are not even aware of existence of such tools. I extensively use these software for my teaching and research. One of my aim is to create awareness about innovative use of Mathematical Software among mathematics teachers across the country. I have been involved with the Mathematics Training and Talent Search (MTTS) programme and Pedagogical

Training for mathematics Teachers (PTMT) for last several years in the various capacities. I am a member of national core committee this programme. These programmes have benefited a lot of students and teacher including me in India and have made a significant impact on mathematical science in India.

MEMBERSHIP OF IN-HOUSE COMMITTEES:

TEQIP Coordinator for Mathematics Department, Campus Safety and Security, Canteen and Catering, Examination Squad.

SEMINARS / LECTURES / CONFERENCES / SYMPOSIA / WORKSHOPS / SUMMER OR WINTER TRAINING SCHOOLS ATTENDED/ ORAL OR POSTER PRESENTATIONS:

Conference/Workshop attended

- International Congress on Mathematics Education (ICME), Hamburg, Germany, July 24–31, 2016.

Lectures Delivered

- A course of lectures (seven) on linear algebra in the mini-MTTS programme at the University of Mizoram, Aizawl, December 12–17, 2016.
- Given a two lectures on “Optimization Techniques using R” on Nov. 25, 2016 in the Refresher course, University of Mumbai.
- Given a series of lectures (4 lectures) on “Mathematics for Social Sciences” on Nov. 15-16, 2016 in a Refresher

course, University of Mumbai.

- Invited to give a series of lectures on “Regression using R” at the SIES Graduate School of Technology, Navi Mumbai on July 05, 2017 during AICTE –ISTE approved Short Term Training Programme.
- Resource person in the 25th Mathematics Training and Talent Search Programme, during May 29–June 24, 2017 held at the Indian Institute of Technology Guwahati.
- Invited to give a series of lectures on “Computational Mathematics & Statistics with R” at the SIWS College, Mumbai on March 04, 2017.

EVENTS ORGANIZED AND RESPONSIBILITY (CONVENER /SECRETARY/ MEMBER):

- Organized and Academic Coordinators, the Silver Jubilee Celebration of Mathematics Training and Talent Search Programme, held at the Regional Institute of Education, Mysure, May 19-20, 2017.
- Organized as an academic coordinator, “mini-MTTS Programme” held at the Ramnarain Ruia College Mumbai, during April 10–15, 2017.
- Organized a two days workshop on “Machine Learning with Python” during March 08-09, 2017 at ICT Mumbai. The programme was funded by

TEQIP.

- Organized a two day workshop on “Data analysis with Python” during Feb.06-07, 2017. The programme was funded by TEQIP.
- Organized a workshop on

- “Pedagogical Training using ICT Tools” during Oct. 08-09, 2016 at ICT Mumbai.
- Organized a workshop on “Computational Mathematics with Sage” during Sept. 23-24, 2016 at ICT Mumbai.

- Organized a 2nd workshop on “Statistical Data Analysis using R” during September 16-17, 2016 at ICT Mumbai.
- Organized a workshop on “Statistical Data Analysis using R” during August 13-14, 2016 at ICT Mumbai.



DR. AKSHAY S. RANE

M.Sc. (Mumbai University), Ph.D.(IIT Bombay)

Assistant Professor

Ex Assistant Professor, Department of Mathematics, BITS Pilani, KK Birla Goa Campus.

SUBJECTS TAUGHT:

B. Tech.

- Applied Mathematics I
- Applied Mathematics II
- Engineering Applications of Computer

M.Sc. in Engineering Mathematics:

- Applied Linear Algebra
- Complex Analysis
- Differential Equations

RESEARCH INTERESTS:

- Numerical Functional Analysis
- Asymptotic expansions for approximate solutions of operator equations and eigenvalue problems.
- Fixed Point Theory

PUBLICATIONS:

International (peer reviewed) so far: 05

National (peer reviewed): 0

CONFERENCE PROCEEDINGS/PAPERS: 03

SEMINARS/LECTURES/ ORATIONS DELIVERED: 04

POST GRADUATE THESIS SUPERVISION: 04

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT):

In my doctoral thesis, I have worked on the asymptotic expansions of approximate solutions of operator equations and eigenvalue problems with non smooth kernels. The operator approximation considered to approximate the integral operator was the classical Nystrom operator and the iterated collocation operator. We developed the asymptotic series expansions for the approximate solution of operator equations and the approximate eigenvalue. Once asymptotic expansion of approximate solutions is established extrapolation can be used to increase the order of convergence of the approximate solutions. Recently I extended these results to the classical

iterated Galerkin method and obtained a series expansion for a simple eigenvalue. I have also worked on the weakly singular kernels. I have developed asymptotic expansion of multiple eigenvalues of integral operators. In the future, I intend to study the operator equations on surfaces and develop efficient method to obtain better solutions than the existing ones. I also intend to develop asymptotic series expansions for the same. I am also interested in fixed point theory, applications and operator theory.

TALKS:

- Presented a talk at the 31st Ramanujan Mathematical society conference from 18th – 21st June, 2016.
- Presented a talk at the 15th International Conference on Integral Methods in Science and Engineering at the university of Brighton, U. K. from 16th -20th July 2017.



DR. V. DIVYA

M.Math. (ISI Bangalore), Ph. D. (University of Genoa, Italy)
UGC Assistant Professor

SUBJECTS TAUGHT:

B. Tech.

- Applied Mathematics II

M.SC. IN ENGINEERING MATHEMATICS:

- Differential Equations-II

RESEARCH INTERESTS:

- Fluid mechanics (theoretical and computational) and applications to fluid-structure interaction
- Non-linear dynamics and reduced-order modelling
- Statistical analysis of turbulence and applications to hydromechanics equations
- Inverse problems and parameter identification

PUBLICATIONS:

International (peer reviewed)

so far: 5

National (peer reviewed): 0

CONFERENCE

PROCEEDINGS/PAPERS: 03

SEMINARS/LECTURES/

ORATIONS DELIVERED: 04

POST GRADUATE PROJECT

SUPERVISION: 01

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT):

My major research interests lie in the area of fluid mechanics and non-linear dynamics. I mainly work on computational modelling of flows around moving immersed boundaries and its applications to fluid-structure interaction. Applications of this research include the flow around a bluff body that is coated with a layer of poro-elastic feathers, and the

phenomenon of flocking in bird flight. Some of these problems, that involve very expensive computational resources can also be effectively investigated using methods of reduced-order modelling, wherein some key features of the ambient flows are captured using inexpensive non-linear dynamical models. I am also involved with statistical analysis of turbulence and its applications to hydromechanics, in which there has been a publication.

1. Divya Venkataraman, Samriddhi Sankar Ray, "The onset of thermalisation in finite-dimensional equations of hydromechanics: Insights from the Burgers equation", Proceedings of the Royal Society A, 473, January 2017, 20160585.



DR. AMIYA RANJAN BHOWMICK

M.Sc. (IIT Bombay), Ph. D. (Calcutta University)
Assistant Professor

SUBJECTS TAUGHT:

B. Chem. Engg.

- Applied Mathematics I

- Applied Mathematics III

B. Tech.

- Applied Mathematics – I

- Applied Mathematics-II

M.Sc. in Engineering Mathematics:

- Applied Statistics-I
- Applied Statistics-II
- Mathematical Biology

RESEARCH INTERESTS:

- Stochastic population dynamics
- Species distribution modeling under climate change
- Machine learning techniques in ecology
- Inference on growth curve models

PUBLICATIONS:

International (peer reviewed): 4
National (peer reviewed): 0

CONFERENCE

PROCEEDINGS/PAPERS: 04

SEMINARS/LECTURES/

ORATIONS DELIVERED: 07

POST GRADUATE THESIS

SUPERVISION: 02

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT):

My major research interest lies in the area of mathematical biology. I am mainly working on the empirical assessment of the natural population dynamics by using population growth models. The single population dynamic models such as logistic, gompertz etc. are used to study the natural populations and make predictions regarding extinction threats. Stochastic population dynamics are integrated part of the research activities. I am also involved in research work related to species distribution modelling.

Research on the Inference on

Growth Models: Growth curve models play an instrumental role to quantify the growth of biological processes and

have immense practical applications across disciplines. In the modelling approach, the absolute growth rate and relative growth rate (RGR) are two most commonly used measures of growth rates. RGR is empirically estimated by Fisher (1921) assuming exponential growth between two consecutive time points and remains invariant under any choice of the underlying growth model. In this article, we propose a new measure of RGR, called modified RGR, which is sensitive to the choice of underlying growth law. The mathematical form of the growth equations are utilized to develop the formula for model dependent growth rates and can be easily computed for commonly used growth models. We compare the efficiency of Fisher's measure of RGR and modified RGR to infer the true growth profile. To achieve this, we develop a goodness of fit testing procedure using Gompertz model as a test bed. The relative efficiency of the two rate measures is compared by generating power curves of the goodness of fit testing procedure. The asymptotic distributions of the associated test statistics are elaborately studied under Gompertz set up. The simulation experiment shows that the proposed formula has better discriminatory power than the existing one in identifying the true profile. The claim is also verified using existing real data set on fish growth. An algorithm for the model selection mechanism is also proposed based on the modified RGR and is generalized

for some commonly used other growth models. The proposed methodology may serve as a valuable tool in growth studies in different research areas.

1. Chakraborty, B., Bhowmick, A. R., Chattopadhyay, J. and Bhattacharya, S. Physiological Responses of Fish under Environmental Stress and extension of Growth (Curve) Models, Ecological Modelling (2017) Vol 363, pp 172-186, November 10, 2017.
2. Mukhopadhyay, S. Hazra, A., Bhowmick, A. R., Bhattacharya, S. On Comparison of Relative Growth Rates under Different Environmental Conditions with Application to Biological Data. Metron. (2016) DOI:10.1007/s40300-016-0102-y. December 2016, Vol 74, Issue 3, pp 311-337.
3. Chattopadhyay, A., Saha, B., Bhowmick, A. R. and Bhattacharya, S. Allee effect and associated risk of species extinction: An empirical study based on global population dynamics database. Nonlinear Studies 23(1) 1-15 (2016)
4. Bhowmick, A. R., Bandyopadhyay, S., Rana, S. and Bhattacharya, S. A Simple Approximation of Moments of the Quasi-equilibrium Distribution of an Extended Stochastic theta-logistic Model with Non-integer Powers, Mathematical Biosciences (2016) 271 (96-112)

SEMINARS / LECTURES /

CONFERENCES / SYMPOSIA
/WORKSHOPS / SUMMER
OR WINTER TRAINING
SCHOOLS ATTENDED/
ORAL OR POSTER
PRESENTATIONS:

**Conference/Workshop
Attended**

- 4th India Biodiversity Meet 2016 (24-27th September) organized by the Agricultural and Ecological Research Unit, Indian Statistical Institute, Kolkata and Government College of Engineering and Textile Technology, Berhampore (Invited Talk).

Invited Lectures delivered

- Delivered a lecture on "Introduction to Mathematical Biology" in the

ISTE approved workshop for faculty members on "Role of Mathematics and Statistics in Engineering Field" during July, 3-8, 2017 at VESIT, Navi Mumbai.

- Resource person in ISTE approved workshop for faculty members on "Data analytics with R Programming", from July 03-07, 2017 at IT Department, SIES GST, Nerul.
- Resource person in the Workshop "Modern Ecological and Agricultural Practices with Statistical Methodologies and R software" held in North Eastern Hill University, Tura Campus, Meghalaya, India during 30th-31th March 2017.

EVENTS ORGANIZED
AND RESPONSIBILITY
(CONVENER /SECRETARY/
MEMBER):

- Coordinator of Workshop on Machine Learning Using R (Sept 30 - Oct 1, 2016) organized by the Department of Mathematics, Institute of Chemical Technology, Mumbai. The workshop is financially supported by TEQIP-II.
- Coordinator of National Seminar on Computational and Mathematical Biology (10th - 11th September 2016) organized by the Department of Mathematics, Institute of Chemical Technology, Mumbai. The seminar series is financially supported by TEQIP-II.

SUPPORT STAFF



SRI C. R. BORADE
Lab attendant