Department of Mathematics

Thrust Areas

The role and usages of mathematics have increased manifold in the last few decades with the setting in of information revolution which has resulted in substantial changes in various other disciplines of knowledge. This has put newer demands on mathematics from the point of view of teaching, research and applications. Skills in computational mathematics are needed more than ever before. Some branches of mathematics like Fractals, Wavelets, Fuzzy Automata, Theory of Computation, Scientific Computation and Software Development, Number Theory and Cryptography, Computational Continuum Mechanics, Information and Coding Theory etc are now part of the main stream. The Department is mainly involved in the following thrust areas of Mathematics.

Wavelets, Fractals & Chaos and Mathematical Analysis

Wavelets, Fractals and chaos are new frontiers of science and important emerging interdisciplinary areas of research nowadays. Wavelets and fractals have significant contributions in the fields of image and signal processing, image compression, data compression and other various approximations. Almost all branches of sciences and engineering are benefitting from the new insights provided by them. Many shapes found in nature which are highly rough and complex at different scales, fractal interpolation methods are popularly accepted approximation tools in such cases. Mathematical analysis provides the foundation for further development in these areas. The applications of explorations in these areas encompasses various disciplines of sciences, engineering, medicine, business, weather forecasting and several other areas of human activities.

Number of faculty members: 05  Number of Publications: 93
Number of Research Scholars: 05  Number of M.Tech Dissertations: 03

Numerical Analysis and Computational Continuum Mechanics

The numerical solution of the problems occurring in Computational Continuum Mechanics is of great practical importance. The governing simultaneous ordinary and partial differential equations remain highly nonlinear and therefore, cannot be solved analytically. These equations can be solved numerically by using numerical methods such as finite element, finite difference, quasilinearization, mesh free methods.

Number of faculty members: 10  Number of Publications: 109
Number of Research Scholars: 07  Number of M.Tech Dissertations: 05

Statistics, Queuing, Fuzzy and Information Theory

In this age of information revolution the role of statistics, fuzzy sets and information theory is of prime importance. The statistical data are not always precise numbers, or vectors, or categories. Real data are frequently what is called fuzzy. Also the results of measurements of such data can be best described by using fuzzy numbers and fuzzy vectors. Statistical analysis methods have to be adapted for the analysis of fuzzy data. Queuing theory deals with problems which involve queuing (or waiting) and the key issue in handling such situations is the idea of uncertainty in inter-arrival times and service times. On the other hand, information theory deals with the study of problems concerning information processing, information storage, information retrieval and decision-making. This includes
the study of uncertainty measures and various practical and economical methods of coding information for transmission.

Number of faculty members: 05  Number of Publications: 83
Number of Research Scholars: 03  Number of M.Tech Dissertations: 07
* Thrust/ Emerging Areas of respective departments mapped to funding agencies:

Mathematics:

- Dr. Vivek Kumar has worked till 2010 on a DST-SERC Fast Track Project for Young Scientists (of Amount Rs. 12.48 Lacs) Titled as “Development of numerical techniques for hyperbolic conservation laws and boundary layers problems”.

Department of Mathematics

Wavelets, Fractals and Chaos, Mathematical Analysis

A. Publications in International Journals:


**B. National Journals:**


C. International Conferences:


74. Chaturvedi A.K., “M-Uniform and CMS Modules,” In the Proceeding, Algebra and its Applications: Recent Development, Editor(s): Afzal Beg, Mohammad


D. National Conferences: Nil

E. Abstract in International Conferences:


F. Abstract in National Conferences:


89. Prasad B., Sahni R., “A convergence result for Jungck - Ishikawa iteration process”, National Meet on History of Mathematical Sciences held at Department of Mathematics, University of Delhi, Delhi, January 7-9, p-21, 2010.


Numerical Analysis and Computational Continuum Mechanics

A. Publications in International Journals:


**B. National Journals**


**C. International Conferences**


76. Chattopadhyay A, **Kumari P.,** “Propagation of G type seismic waves in a homogeneous isotropic layer over a non-homogeneous isotropic half-space”, ISM Dhanbad, India, Jan 11-13, 2011.


**D. National Conferences: Nil**

**E. Abstracts in International Conferences**


91. **Kumari P.,** Sharma V.K., Effect of rigidity and density variation on propagation of torsional wave, 2nd International Science Congress, 8-9th Dec, 2012, held at Vrindavan (Mathura).


**F. Abstract in National Conferences**


98. Gupta D., **Kumar L.,** Singh B. “Numerical solution of the mixed convection micropolar fluid past a continuously moving plate in the presence of radiation”,


Mathematical Society at Department of Mathematics, R. D. University, Jabalpur (MP), December, 2006.


**Statistics, Queuing, Fuzzy and Information Theory**

A. **Publications in International Journals:**


4. Goyal M., Yadav D., **Tripathi A.**, “Intuitionistic fuzzy approach to classify the user based on assessment of learner’s knowledge level in e-learning decision making”, *Journal of information processing system*, 2014


49. Jha P.C., Gupta D., Anand S., Kapur P.K., “An Imperfect Debugging Software Reliability Growth Model using lag function with testing coverage and related allocation of testing effort problem”, Communications in Dependability and
B. National Journals

50. **Choubey (Tripathi) A., Ravi K. M.,** "Vague Regular Language", Advances in Fuzzy Mathematics (Research India Publications), Vol. 40, pp. 147-165, 2009


C. International Conferences


D. National Conferences


E. Abstract in International Conferences

68. Amit Srivastava (with S. Maheshwari), “A New Parametric Fuzzy Entropy Measure and Its properties” to be presented in Twenty-first International
Conference on Information and Mathematical Sciences to be organized by Baba Farid College of Engineering & Technology, Bhatinda in collaboration with Indian Society of Information Theory & Its Applications from 24th October, 2013 to 26th October, 2013.


F. **Abstract in National Conferences**


Annexure-M-3

Completed/Ongoing Ph.D Dissertations (Mathematics Department; JIIT)

Ph.D. Thesis (Completed)

Wavelets, Fractals and Chaos, Mathematical Analysis
1. Some Applications of Fixed Point Theorems

Numerical Analysis and Computational Continuum Mechanics
2. Numerical Studies of Stresses in transversely Isotropic Materials
3. Some Stability Problems of Non-Newtonian Fluids
4. Some Thermal Stability Problems of Elasto-Viscous, Ferromagnetic and Nanofluids
5. Non-linear Problems in Micropolar Fluid Flow
6. Non-Linear Stress Analysis of Thick- Walled Circular Cylinders

Statistics, Queuing, Fuzzy and Information Theory
7. Some Investigations in Fuzzy Automata
8. Performance Analysis of Some Queueing Models
9. Some Special Classes of Efficient Multiple Bursts Codes
10. Information Measures and Aggregation Operators on Fuzzy/Intuitionistic Fuzzy Sets with Applications in Decision Making
11. Efficient codes with class errors of SK-Metric and polynomial power product composition for codes

Ph.D Thesis (Ongoing)

Wavelets, Fractals and Chaos, Mathematical Analysis
1. Fractals and Their Applications
2. Fixed Point Theory and Fractals
3. Some Investigations in Fractal Theory
4. Growth Properties and Spaces of Vector Valued Entire Dirichlet Series
5. Growth and Approximation of Entire and Analytic Functions

Numerical Analysis and Computational Continuum Mechanics
6. A Study of Seismic Wave Propagation in Different Anisotropic Media
7. Numerical Studies of Stresses in Materials
8. Safety Analysis of Anisotropic Materials
9. Nonlinear MHD Flow Problems of Micropolar Fluids
10. Numerical Solution of Some Nonlinear Problems in Nanofluids
12. Application of Homotopy Analysis to Nonlinear Differential Equations

Statistics, Queuing, Fuzzy and Information Theory
13. Study of Generalized Fuzzy Sets and Fuzzy Topology
14. Study of Extended Fuzzy Sets
15. Study of Generalized Measures of Information and Divergence and its Applications in Coding Theory
Completed/Ongoing M.Tech Dissertations (Mathematics Department; JIIT)

M. Tech (ACM) Dissertations (Completed)

Wavelets, Fractals and Chaos, Mathematical Analysis
1. Approximations by Wavelets
2. Fixed Point Theory in Fractals.
3. Iterated Function Systems and Chaotic Maps

Numerical Analysis and Computational Continuum Mechanics
5. Mesh Free Methods for Boundary Value Problems
6. Nonlinear Differential Equations
8. Numerical Solutions of Boundary Value Problems using Splines

Statistics, Queuing, Fuzzy and Information Theory
9. Image Compression by using Fuzzy Techniques
10. Fuzzy Linear Programming
11. Face Recognition with Fuzzy C-Mean Algorithm using Principal Component Analysis
12. Multi-Objective Linear Programming Problems
13. Error Control Coding
14. Digital Signature Scheme Based on Error correcting Code
15. Cluster Analysis

M. Tech (ACM) Dissertations (Ongoing) NIL
Annexure-M-5

10M1NMA431 Wavelets and Applications (3 Credits)


13M1NMA331 Fractals and Chaos (3 Credits)

Metric Space; Review of metric spaces, complete metric space, contraction mappings, Hutchinson operator, Banach contraction theorem, Hausdorff metric and the spaces of fractals, iterated function systems (IFS), attractor of IFS. Fractals; Introduction, fractals in nature, mathematical fractals, Koch curve, Koch snowflake, Cantor set, Sierpinski triangle, Sierpinski gasket. Fractal Dimensions; Box counting dimension, Hausdorff-Besicovitch dimension, dimensions of the well known fractals, theoretical determination of fractal dimension. Fractal Interpolation; Fractal interpolation functions, fractal dimension of fractal interpolation functions. Chaos; Dynamical systems, orbits, repelling and attracting fixed points, logistic map, bifurcations, brief introduction about the Julia and the Mandelbrot sets.

13M1NMA231 Advanced Numerical Techniques (3 Credits)

Rayleigh-Ritz method, finite element method for one dimensional problems.

10M13MA432 Computational Fluid Dynamics (3 Credits)


13M1NMA214 Linear Statistical Models (3 Credits)