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.

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 benefiting 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: 01 Number of Publications: 122
Number of Research Scholars: 06 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: 201
Number of Research Scholars: 17 Number of M.Tech Dissertations: 05

Statistics, Fuzzy, Information Theory and Operations Research

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: 10 Number of Publications: 121
Number of Research Scholars: 16 Number of M.Tech Dissertations: 07

Annexure-M-1

* 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 numericaltechniques for hyperbolic conservation laws and boundary layers problems*".

Annexure-M-2

Department of Mathematics

Fractals and Chaos, Mathematical Analysis

A. Publications in International Journals:

1. Chhaya Singhal and **Srivastava G.S.**, On the growth and approximation of entire functions represented by Laplace -Stieltjes' transformation, *Ann Univ. Ferrara,* Vol. 63:, pp. 365–376, 2017.
2. **Kumar Singh A. K.**, Outer measure on effect algebras, *Mathematica Slovaca*, 67 (4), 811-818, 2017.
3. **Prasad, B.** and Katiyar, K., The Attractors of Fuzzy Super Iterated Function Systems, Indian Journal of Science and Technology, (Print ISSN : 0974-6846 Online ISSN : 0974-5645), pp.1-8, 2017.
4. **Prasad, B.** and Goyal K., Stability Result of Iterative Procedure in Normed Space, International Journal of Control Theory and Applications, Vol. 9(20), 2016, pp. 9465-9474.
5. Akanksha Sharma and **G.S.Srivastava**, Coefficient multipliers on spaces of vector valued entire Dirichlet series, *Mathematica Bohemica,*Vol. 142, No. 3, pp. 299-307, (2017). 10.21136/MB.2017.0026-16
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7. Akhilesh Kumar Singh, Outer measure on effect algebras, Mathematica Slovaca, 67 (4) (2017), 811-818.

8. **Prasad, B.** and K. Katiyar, Multi fuzzy fractal theorems in fuzzy metric spaces, Fuzzy Information and Engineering, (ISSN: 1616-8658) vol. 10(28), pp. 225-236, 2017308.
9. Mishra, K. and **Prasad, B.,** Some Generalized IFS in Fuzzy Metric Spaces, Advances in Fuzzy Mathematics 12 (2), 297-308, 2017.
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12. **Prasad B.** and Goyal K., "Stability Result of Iterative Procedure in Normed Space", *International Journal of Control Theory and Applications*, Vol. 9(20), 2016, pp. 149-158.
13. **G.S.Srivastava** and Chhaya Singhal, On the order and lower order of Laplace-Stieltjes transformations with index pair (p,q), *Italian J.Pure Appl. Math.*36 , 975-986,2016

14. **Srivastava G.S.** and Kumar S., "Approximation and generalized growth of solutions to a class of elliptic partial differential equations", *Funct. Approx. Comment. Math*, Vol. 54, Issue 1, pp. 95-113, 2016.
15. **Prasad B.** and Goyal K., "Stability of iteration for some general operators in b-metric spaces," *International Journal of Computer & Mathematical Sciences*, Vol. 5, Issue 4, pp.78-83, 2016.
16. Tamsir M., Acan O., Kumar J. and **Singh A. K.**, "Numerical Study of Gas Dynamics Equation arising in Shock Fronts", *Asia Pacific Journal of Engineering Science and Technology*, Vol. 2, Issue 1, pp. 17-25, 2016.
17. **Shukla Suresh K**., Pandey P. N., Saxena Shivalika, "Lagrange spaces with generalized (γ, β)-metric", *Facta Universitatis (Nis) ¡ Ser. Math. Inform.*, Vol. 31(1) pp. 201-212, 2016.
18. **Srivastava G.S.** and Singhal C., "On the generalized order and generalized type of Laplace-Stieltjes transformation convergent in the right half-plane",*Global Journal of Pure and Applied Mathematics*. Volume 11, Number 1, pp. 469-477,2015.
19. **Singh A. K.,** "Variations on effect algebras", *Proceedings of National Academy of* Sciences, India Section A: Physical Sciences, Vol. 85, pp.83-86, 2015.
20. **Singh A. K.,** Kumar M., "Multi-peak solution of non-Linear elliptic singularly perturbed reaction-diffusion equations using finite element simulations", *Journal of Taiwan Institute of Chemical Engineers*, Vol.50, pp.56-68, 2015.
21. Kumar M., **Singh A. K.**, Srivastava A, "A new fifth order derivative free Newton type iterative method for solving nonlinear equations", *Applied Mathematics and Information Sciences*, Vol. 9 ,No. 3 pp. 1507-1513, 2015.
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26. Kumar S. and **Srivastava G.S.**, "On the maximum term and lower order of entire monogenic functions", *Transylv. J. Math. and Mech*.,Vol.6,Number 1, 29-38, 2014.
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28. **Prasad B.** and Katiyar K., "A stability analysis of logistic model", *International Journal of Nonlinear Sciences*, Vol. 17, Issue 1, pp. 71-79, 2014
29. **Prasad B.,Singh B.** and Katiyar K., "Modeling curves via fractal interpolation with VSFF", *International Journal of Computer Applications*, Special Issue ICACEA-2014, pp. 191-194, 2014.
30. Kumar M., **Singh A. K**, "Singular perturbation problems in nonlinear elliptic

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35. **Prasad B.** and Sahni R., "Endpoints of multivalued contraction operators", *ISRN Mathematical Analysis,* Vol. 2013, pp. 1-7, 2013.
36. **Prasad B.** and Mishra K., "Fractals in G-metric spaces", *Applied Mathematical Sciences*, Vol. 7, Issue 109, pp. 5409 - 5415, 2013.
37. **Singh A. K**, "A study of Non-atomic measures and integrals on effect algebras", *Journal of Nonlinear Analysis and Optimization: Theory and Applications*, Vol. 4 (1), pp.99-110, 2013.
38. Kumar M., **Singh A. K.**, Srivastava A, "Various Newton type iterative methods for solving nonlinear equations", *Journal of Egyptian Mathematical Society*, Vol. 21, pp.334-339, 2013.
39. **Singh B.,** Bhardwaj A., Ali R., "Wavelet Optimized Adaptive Mesh for MHD Flow Problems", *Applied Mathematics*, Scientific Research, USA, Vol. 3, pp. 127-134, 2012.
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B. National Journals:

66. Sharma A. and **Srivastava G.S**., "Spaces of Analytic Functions Represented by Vector Valued Dirichlet Series in a Half Plane", International Bulletin of Mathematical Research,Vol. 2, Issue 1, 68-74, 2015.

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71. Tyagi K., **Tripathi A**., "Approximate Equalities Using Generalized Topological Space", *Advancement in Mathematical Sciences, AIP Conference Proceedings*, vol. 1897, no. 1, (2017).
72. **Singh A. K.** , Functions of bounded variation on effect algebras, *Advancement in Mathematical Sciences, AIP Conference Proceedings*, 1897, 020022 (2017); doi: 10.1063/1.5008701.
73. Shivalika Saxena, P. N. Pandey, and Shukla **S. K.,** Geometric objects recurrent in a direction and directionally recurrent Finsler spaces, *Advancement in Mathematical Sciences, AIP Conference Proceedings*, 1897, 020025 (2017); https://doi.org/10.1063/1.5008704.
74. Mishra, K. and **Prasad, B.,** "Iterated function systems in G b-metric space", *Advancement in Mathematical Sciences, AIP Conference Proceedings,* 1897(1), pp.020035:1-8 (2017); doi: 10.1063/1.5008714.
75. Katiyar, K. and **Prasad, B.**, Construction of RFIF using VVSFs with application, AIP Conference Proceedings 1897(1), 020027 (2017); pp. 020027:1-8.doi: 10.1063/1.5008706.
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78. **Akhilesh Kumar Singh**, Functions of bounded variation on effect algebras, AIP Conference Proceedings 1897, 020022 (2017); doi: 10.1063/1.5008701
79. Shivalika Saxena, P. N. Pandey, and **Suresh K. Shukla**, Geometric objects recurrent in a direction and directionally recurrent Finsler spaces, AIP Conference Proceedings 1897, 020025 (2017); https://doi.org/10.1063/1.5008704
80. **Prasad, Bhagwati,**Singh, Bani and Katiyar, Kuldip, A Hidden Variable Fractal Interpolation Surface Method, In: Manish Gupta, Manish Goyal (eds.), Information and Mathematical Sciences IMS-2013, pp. 156-158. (Elsevier India, Print ISBN: 978-93-5107-162-4).
81. **Prasad B.**, Katiyar K., "Fractal Patterns of the Noor Iterates of Complex Logistic Map" Proceedings (ISBN:978-9381583-67-8) of the International Conference on Recent Trends in Computing (ICRTC 2012), SRM University, Ghaziabad, UP, India (2012), pp. 229-232.
82. **Prasad B.,** Katiyar K., "Complex Dynamics of BRD Sets" Proceedings of the International Conference on Emerging Trends in Science, Engineering and Technology (INCOSET 2012), Lecture Notes in Mechanical Engineering (2012), pp. 683-688.
83. **Srivastava A.**, Singh A.K. & Maheshwari, S. "Dichotomous Exponential Entropy Functional and Its Applications in Medical Diagnosis" *IEEE International Conference on Signal Processing and Communication (ICSC-2013),* pp. 21-26, 2013 organized by Jaypee Institute of Information Technology, Noida from 12th December to 14th December, 2013.(Proceedings published by IEEE)

84. **Prasad, Bhagwati** and Mishra, Kunti, An application of IFS in encryption and compression, in International Conference on Information and Mathematical Sciences, Elsevier, pp. 238-241, 24-26 Oct, 2013(Elsevier India, Print ISBN: 978-93-5107-162-4)

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93. **Prasad B.,** Katiyar, K., Julia set for transcendental function, Proceedings of the IEEE International Conference of Computer Engineering and Technology Jodhpur, India, Nov13-14, 2010, pp.E59-E61.

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D. National Conferences: Nil

E. Abstract in International Conferences:

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112. **Chaturvedi A.K.,** "On Quasi-pseudo Principally Injective Modules" Nineteenth International Conference of FIM on Interdisciplinary Mathematical and Statistical Techniques (IMST 2010 - FIM XIX), Patna University, Patna, Bihar India, p. 38, 18-20 Dec 2010.
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F. Abstract in National Conferences:

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Numerical Analysis and Computational Continuum Mechanics

A. Publications in International Journals:

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B. National Journals

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B. National Journals

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D. National Conferences

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Organized by Jaypee University of Engineering and Techonogy, Guna (Madhya Pradesh) from 7th December to 9th December, 2012.

E. Abstract in International Conferences

105. Tyagi K.,**Tripathi A**., "*Approximate Equalities using rough Intuitionistic Fuzzy Topology*", Book of abstract pp. 906, International Conference on Recent Tends in Engineering and Material Science (ICEMS), Elsevier, Jaipur National University, March 17-19, 2016, Jaipur, Rajasthan, Oral Presentation**.**
106. **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 wtith Indian Society of Information Theory & Its Applications from 24th October, 2013 to 26th October, 2013.
107. **Amit Srivastava**(with S. Maheshwari), "A New Fuzzy Entropy Measure and Its Properties"National conference on Role of Mathematics in Advancement of Science & Technology Organized by Bappa Sri Narain Vocational P.G. College (KKV), Lucknow from 18th October to 20th October, 2013
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109. **Srivastava A.,** Maheshwari S. (2012) "A New Variant of Jensen's Inequality with Application in Information Theory International conference on History and Development of Mathematical Sciences and Symposium on Non linear Analysis organized by Department of Mathematics, Maharshi Dayanand University, Rohtak and Indian Society of History of Mathematics from 21st Nov. to 24th Nov. 2012.
110. Verma R., **Sharma B.D.,** "Jensen-Tsallis divergence on intuitionistic fuzzy sets and their applications," Book of abstract pp. 103, International Conference on Advances in Modeling, Optimization and Computing (AMOC -2011) December 5-7, 2011, Department of Mathematics, IIT Roorkee.
111. **Srivastava, A.,** " On Some New bounds of weighted Entropy Measures", 16th Annual cum 2nd International Conference of Gwalior Academy of Mathematical Sciences (GAMS)and 2nd International Conference of Bioinformatics Under the Aegis of IFIP- TC 5 and Computer Society of India with Symposia on Recent Trends in Applications of Mathematical Modeling in Engineering, Physical & Social Sciences and Bioinformatics and its Applications Organized by S.S. Dempo College of Commerce and Economics, Altinho, Panaji, Goa, 22nd - 25th September, 2011.
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113. Jha, P.C., Kumar, D., **Gupta, D.**, Kapur, P.K., "Optimal Release Policy for a Software System with Testing Effort", International Conference on Operations Research Applications in Infrastructure Development in conjunction with the 2005 Annual Convention of Operational Research Society of India, ICORAID-2005-ORSI, Indian Institute of Science, Bangalore, pp. 216, December 27-29, 2005.
114. **Sharma B.D.,**"Product of matrices for efficient codes", International Conference on Discrete Mathematics ICDM-2008, Mysore University, Mysore, June 06-10, 2008.
115. **Sharma B.D.,**"A study in coding using generalized distances", Eighteenth International Conference of Forum for Interdisciplinary Mathematics on Interdisciplinary Mathematical & Statistical Techniques (IMST 2009 – FIM XVIII,) Jaypee University of Information Technology, Waknaghat, Solan (H.P) India, pp. 25, August 2- 4, 2009.

F. Abstract in National Conferences

116. Verma R., Sharma B.D., "Hesitant interval-valued fuzzy sets and their properties" Book of abstract pp. 40, National Conference on Modeling, Computational Fluid Dynamics and Operations Research (NCMOC -2012) February 4-5, 2012, Department of Mathematics, BITS Pilani, Pilani Campus, Rajasthan.
117. Verma R., Sharma B.D., "Cosine similarity measure for interval-valued intuitionistic fuzzy sets and its application to multi-criteria decision making problem," Book of abstract pp. 26, National Meet of research Scholars in Mathematical Sciences (NMRSMS-2011), October 12-15, 2011, Department of Mathematics, IIT, Kharagpur.
118. Srivastava A., "Parametric Measure of Uncertainty in queuing Systems", *National Seminar on 'Interface Between Statistics, Mathematics and Allied Sciences' (IBSMAS-2010)* organized by Department of Statistics, Kumaun University, Almora from 20th November to 22nd November, 2010.
119. **Gupta D.**, "Release Policy for a Discrete Flexible Model incorporating the effect of Fault Removal Efficiency under Fuzzy Environment", National Conference on Emerging Trends in Statistical Methods And Optimization Techniques, Department of Statistics, University of Jammu, Jammu, Feburary 22-23, 2008.
120. Jha, P.C., **Gupta D.**, Gupta, Anshu, Kapur, P. K., "Fuzzy Release Time Problem for Multiple Types of Faults in a Software", 40th Annual Convention of Operational Research Society of India, Indian National Science Academy, Bahadur Shah Zafar Marg, New Delhi, Dec 04-06, 2007.
121. Jha, P.C., Gupta, Anshu, **Gupta D.**, Kapur, P. K., "Optimal Allocation of Testing Effort Considering Cost and Reliability for flexible software reliability growth model", National Conference on Mathematical Modeling Optimization and Their Applications, Bharti Vidyapeeth's Institute of Computer Applications and Management, Delhi, pp. 30, April 28-29, 2007.

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
2. A study of Growth Properties and Spaces of Vector Valued Dirichlet Series
3. Growth and Approximation of Entire and Analytic Functions
4. A Study of Fractals and Fractal Interpolation
5. Some Investigations in Fractal Theory
6. Studies on Fixed Point Theory for Various Maps in General Spaces

Numerical Analysis and Computational Continuum Mechanics

7. Numerical Studies of Stresses in transversely Isotropic Materials
8. Some Stability Problems of Non-Newtonian Fluids
9. Some Thermal Stability Problems of Elastico-Viscous, Ferromagnetic and Nanofluids
10. Non-Linear Stress Analysis of Thick- Walled Circular Cylinders.
11. Non-linear Problems in Micropolar Fluid Flow
12. Nonlinear MHD Flow Problems of Micropolar Fluids
13. Numerical Studies of Stresses in Materials
14. A Study of Seismic Wave Propagation in Different Anisotropic Media
15. Numerical Study of MHD Flow and Heat Transfer Problems in Nanofluids

Statistics, Queuing, Fuzzy and Information Theory

16. Some Investigations in Fuzzy Automata
17. Performance Analysis of Some Queueing Models
18. Some Special Classes of Efficient Multiple Bursts Codes
19. Information Measures and Aggregation Operators on Fuzzy/Intuitionistic Fuzzy Sets with Applications in Decision Making
20. Efficient codes with class errors of SK-Metric and polynomial power product composition for codes
21. Generalized Measures of Information and Divergence and their Applications
22. Generalisation of Topology, Automata and Decision Theory Using Rough Fuzzy Sets
23. Study of Extended Fuzzy Sets

Ph.D Thesis (Ongoing)

Fractals and Chaos, Mathematical Analysis

none

Numerical Analysis and Computational Continuum Mechanics

1. Safety Analysis of Anisotropic Materials
2. Solution of Differential Equations using Numerical and Emerging Computing Techniques
3. Application of Homotopy Analysis to Nonlinear Differential Equations
4. Stability Problems of Fluid Dynamics
5. Solutions of Nonlinear Partial Differential Equations
6. Thermal Stability Analysis in Nanofluids
7. Numerical Solution of Some Problems in Nanofluid
8. Elastic-Plastic and Creep Stress Analysis in Anisotropic Materials.

Statistics, Fuzzy, Information Theory and Operations Research

9. Mathematical and Statistical Methods in Object Recognition
10. Optimal Solution of Pattern Matching Problems
11. Segmentation and Retrieval Problems in Image Processing
12. Fuzzy Optimization and Decision Making
13. Fuzzy Logic and Evolutionary Optimization
14. Study of Seismic Wave in Propagation in Layered and Anisotropic Media
15. Some Investigations in Automata Theory and formal languages in Fuzzy Envionment
16. Study of uncertainty measures in crisp and fuzzy environments.

Annexure-M-4

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

4. Finite Element Solution of Magnetohydrodynamic Flow of Micropolar Fluid.

5. Mesh Free Methods for Boundary Value Problems
6. Nonlinear Differential Equations
7. Application of Evolutionary Computation Algorithms in Numerical Optimization Problems
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