Department of

Applied

Mathematics

Magazine

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Message from HOD

Mathematics is the language of Science and the key to understanding the mechanics of our world. The importance of mathematics is due to its increasing effectiveness in steps with the new developments in science. We are living in an era where digital system has become an integral part of our daily life. In this era of emerging technologies and advanced sciences, we are focusing on applied research by using knowledge linkages between scientists, engineers and researchers. Mathematics and Statistics form backbone for knowledge development for scientists and engineers.

The Department of Applied Mathematics aims to impart the sound knowledge of Mathematics, Statistics and Computing to the students through teaching, research and innovation. The department is achieving its goals/objectives with the help of highly qualified and dedicated faculty. The research output of the Department is very impressive and speaks clearly for the quality of work. Faculty members are actively involved in research and vary academic activities in India and abroad.

The Department offers one UG program, B.Tech. (Mathematics & Computing) and one PG program, M.Sc. in Mathematics. The Department provides services to the entire University for UG students of engineering.

Prof. Sangita Kansal

Courses offered by the Department:

- **B.Tech. (Mathematics and Computing):** This program is an amalgamation of Mathematics with Computer Science and Financial Engineering. The curriculum has been designed to meet the needs of sophisticated mathematics for modern scientific investigations and technological developments. The students are being enriched with in-depth theoretical background and practical training in Numerical Computing, Operations Research, Computer Science and Mathematical finance by a team of committed faculty members from the disciplines of Pure Mathematics, Applied Mathematics, Computer Engineering, Information technology and Economics. These students are highly demanded by the recruiters of the top companies. They are also getting admission for higher studies in the top most Universities of India & abroad.

- **M.Sc. (Mathematics):** The Department of Applied Mathematics is one of the oldest departments and it is the pride of DTU. The Department is achieving its goals/objectives with the help of highly qualified faculty, who are actively involved in teaching, research, projects and various academic activities. The Department has started a Master of Science Program in Mathematics in the academic year 2019-20. Initially, the number of seats allocated for this programme was 30 but then the number of seats gradually increased.

- **Ph.D.:** The Department of Applied Mathematics also offers Ph.D. programme in various areas of Mathematics like Information Theory, Graph Theory and Petri net Theory, Numerical Simulation, General Relativity and Cosmology, Complex Analysis, Algebra, Approximation Theory, Operations Research, Optimization Techniques, Numerical Analysis, Mathematical Modelling and Quantum computing.

Achievements/Highlights of the Department: The

Department has eminent faculty members and motivated students who are constantly engaged in various academic activities apart from their curriculum activities. Some of the details are given below:

Research Award: The University has been actively promoting research and innovation by providing a research and innovation environment to the students and faculties. In 2017, the University has started a Research Excellence Award to encourage and motivate faculties and students toward research in respective disciplines. The Award has been classified into three categories, namely, Outstanding Research Awards, Premier Research Awards, and Commendable Research Awards. The following publications were awarded to the Faculty members and Students of the Department of Applied Mathematics in the Research Excellence Awards ceremony held at DTU in March 2020.

Details of Premier Research Awards

Authors	Paper Title	Journal Reference
C. P. Singh and Simran Kaur	Matter creation cosmology in Brans-Dicke theory: Observational tests and thermodynamic analysis	Physical Review D (American Physical Society), vol. 100, no. 8, pp. 084057, 2019.

Anu Kumari and Satyabrata Adhikari	Detection of a mixed bipartite entangled state in arbitrary dimension via a structural physical approximation of partial transposition	Physical Review A (American Physical Society, vol. 100, no. 5, pp. 052323, 2019.

Details of Commendable Research Awards

Authors	Paper Title	Journal Reference
Aditya Kaushik, Anil K. Vashishth, Vijayant Kumar and Manju Sharma	A modified graded mesh and higher order finite element approximation for singular perturbation problems	Journal of Computational Physics (Elsevier) vol. 395, pp. 275-285, 2019.
C. P. Singh and Amit Kumar	Observational constraints on viscous Ricci dark energy model	Astrophysics and Space Science (Springer) vol. 364, no. 6, p. 94, 2019.
Abhishek Kumar and Nilam	Mathematical analysis of a delayed epidemic model with nonlinear incidence and treatment rates	Journal of Engineering Mathematics , vol. 115, pp. 1-20, 2019.

Abhishek Kumar and Nilam	Stability of a delayed SIR epidemic model by introducing two explicit treatment classes along with nonlinear incidence rate and Holling type treatment.	*Journal of Computational and Applied Mathematics (Springer), vol. 38, no. 3, pp.130. (article no), 2019.*
Kanica Goel and Nilam	Stability behavior of a nonlinear mathematical epidemic transmission model with time delay	*Nonlinear Dynamics (Springer), vol. 98, pp. 1501- 1518, 2019.*
Gifty Malhotra, R. Srivastava and H. C. Taneja	Calibration of the risk neutral density function by maximization of a two parameter entropy	*Physica A: Statistical Mechanics and its Applications (Elsevier), vol. 513, pp. 45-54, 2019*
Ram Pratap and Naokant Deo	Approximation by genuine Gupta-Srivastava operatiors	*Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales. Serie A. Matemáticas (Springer), vol. 113, pp. 2495-2505, 2019.*

Publications – Along with the research publications which have been awarded by DTU for their excellence in publication category, faculty members have published their research work in reputed journals/conferences. Details of the current academic year are given below:

- **A. Kumar, Nilam**, and R. Kishor (2019): A Short Study of an SIR Model with Inclusion of an Alert Class, Two explicit Nonlinear Incidence Rates and Saturated Treatment Rate, SeMA Journal, vol. 76(3), pp. 505-519. [DOI: https://doi.org/10.1007/s40324-019-00189-8]

- **A. Kumar, Nilam** (2019), Dynamical Model of Epidemic Along with Time Delay; Holling Type II Incidence Rate and Monod–Haldane Type Treatment Rate, Differential Equations and Dynamical Systems, vol. 27 (1-3), pp: 299-312. [DOI: https://doi.org/10.1007/s12591-018-0424-8]

- **A. Kumar, Nilam**, and R. Kishor (2019): A Short Study of an SIR Model with Inclusion of an Alert Class, Two explicit Nonlinear Incidence Rates and Saturated Treatment Rate, SeMA Journal, vol. 76(3), pp. 505-519. [DOI: https://doi.org/10.1007/s40324-019-00189-8]

- **Vaibhav Kumar, Shubham Pasari, Vallabh Pravin Patil, Sumedha Seniaray**, "Machine Learning based Language Modelling of Code Switched Data", 2020 International Conference on Electronics and Sustainable Communication Systems (ICESC), pp. 552-557, July, 2020.

- **A. Dhiran, D. Kumar, Abhishek and A. Arora**, "Video Fraud Detection using Blockchain," 2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA), 2020, pp. 102-107.

- **A. Arora, S.K. Peddoju, and M. Conti**, "PermPair: Android Malware Detection Using Permission Pairs", in IEEE Transactions on Information Forensics and Security, pp. 1968-1982, 2020.

- **K. Khariwal, J. Singh and A. Arora,** "IPDroid: Android Malware Detection using Intents and Permissions," 2020 Fourth World Conference on Smart Trends in Systems, Security and Sustainability (WorldS4), 2020, pp. 197-202.

Invited Talks: Faculty members and Students of the Department regularly visit other Institutes and Universities to deliver invited talks and to present papers in reputed conferences and workshops. The details for the academic year 2019-20 are given below:

- **Prof. Sangita Kansal** visited DCR University of Science & Technology, Murthal to deliver a lecture on "Graph Theory and Petri Net Theory".

- **Prof. Sangita Kansal** visited UGC-HRDC, Jamia Millia Islamia, New Delhi to deliver a lecture on "Petri Nets: A graphical tool and its various aspects".

- **Prof. Sangita Kansal** visited JNU, New Delhi to deliver a lecture on "Signed Petri Net".

- **Prof. Naokant Deo** invited as a keynote speaker on the topic "Integral Modification of Positive Linear Operators", at International Conference on Mathematical Modeling and High-Performance Computing in Science and Technology, RGPV, Bhopal (M. P), February 12 - 13; 2020.

- **Prof. Naokant Deo** invited as a speaker on the topic "A Generalisations of Positive Linear Operators and Its Variants", at "International Conference on Mathematical Analysis and its Application (ICMAA-2019), Department of Mathematics, South Asian University, Akbar Bhawan, Chanakyapuri, New Delhi, India, December 14 - 16; 2019.

- **Prof. Naokant Deo** invited as a speaker on the topic "Approximation Operators and their Variants", at "Workshop on Recent Trends in Physical Sciences & its Applications, Department of Mathematics, Dr Bhimrao Ambedkar University, Agra, November 7 - 8; 2019.

- **Dr. Nilam** delivered a talk on "Modeling of Delay Differential equations using MATHEMATICA" in VYUTPATTI-2019, organized by Sharda University during April 9-13, 2019.

- **Dr. Nilam** delivered a lecture on "Mathematical modeling of an epidemic with nonlinear functional type incidence and treatment" in 4th International Conference on Recent Developments in Theory, Computation & Application of Differential Equation to Celebrate the 70th Birthday of Prof. MK Kadalbajoo held at SAU Delhi during January 21-23, 2019.

- **Dr. Nilam** delivered a talk on "Modeling of Delay Differential equations using MATHEMATICA" in VYUTPATTI-2019, organized by Sharda University during April 9-13, 2019.

- **Dr. Anshul Arora** delivered an Expert Lecture on "Network Traffic Analysis to Detect Intrusions in Smartphones" in the Special Training Program on "Cryptology and Information Security" organized by Scientific and Analysis Group, DRDO, Delhi from 8th July 2019 to 19th July 2019.

- **Dr. Anshul Arora** delivered two Expert Lectures on "Android Malware Detection" & "Network Traffic Analysis for Intrusion Detection" in the STTP on "Recent Trends in Security and Cryptography", organized by Department of Applied Mathematics, Delhi Technological University, from November 18-22, 2019.

- **Dr. Anshul Arora** delivered two Expert Lectures on "Probability & Stats for Data Science" and "Data Science in Intrusion Detection" in the FDP on "Data Science", organized by Punjab Engineering College, Chandigarh, from May 4-8, 2020.

- **Dr. Satyabrata Adhikari** delivered an invited talk on "Quantum Correlation and Absolute separable state" in the Online Symposium on "Quantum Information and Computation (Quantum Talks)" held online at International Institute of Information Technology, Hyderabad, India, during June, 2020.

Interaction with the outside world:

- **Dr. Goonjan Jain** visited as external expert in the selection committee for selection of student assistants for an industry consultancy project in IGDTUW, Delhi.

Paper presentations:

- **Mr. Jamkhongam Touthang** presented a paper titled as "Contributions of Mathematical Sciences to Industry" at National Conference on Emerging Trends in Mathematical Sciences for Industry and Environment, held during 27th – 29th Jan 2020, organized by Department of Mathematics, South Asian University,

New Delhi 110021 Department of Mathematics, Shaheed Bhagat Singh College, University of Delhi, Delhi 110017

- **Ms. Payal** presented a paper titled as "Dynamical Balanceness in a Signed Petri Net" at International Conference on Recent Advances in Mathematical Sciences, held during 9th – 11th Jan 2020 organized by Jaypee Institute of Information Technology, Noida.

- **Mr. Jamkhongam Touthang** presented a paper titled as "Atomic Systems for Operators in Banach Spaces" at International Conference on Mathematical Analysis and Its Applications (ICMAA-19), held during 14th – 16th Dec 2019, organized by Department of Mathematics, South Asian University, New Delhi 110021.

- **Mr. Jamkhongam Touthang** presented a paper titled as "Recent Applications of Conformal Mappings" at National Conference on Advances in Mathematical Analysis and its Applications, held during 8th – 10th Nov 2019, organized by Department of Mathematics, PGDAV College, University of Delhi.

- **Ms. Mridula Mundalia** presented a paper titled "Inclusion Relations of Strongly starlike Functions" in National Conference on Advances in Mathematical Analysis and its Applications (NCAMAA-2019), held during 8th – 10th Nov 2019 organized by Department of Mathematics, P.G.D.A.V. College, Delhi University, Delhi.

- **Mr. Luckshay Batra** presented a paper titled "Entropy as a measure of implied volatility in Options Market" at 3rd International Conference of Mathematical Sciences (ICMS 2019), held during 4th to 8th Sep 2019, organized by Maltepe University, Istanbul, Turkey.

- **Ms. Monika Choudhary** presented a paper titled as "A defect correction method for singularity perturbed convection- diffusion problem on Shishin mesh", at TEQIP, Online CONIAPS –XXIV, held during 09th to 11th August 2019, organized by CCS University, Meerut.

Academic Achievers of the Department:

- B.Tech. MCE 4th Year Topper: Nishtha Sardana (2K15/MC/47)
- NAMITA SHUKLA (2K16/MC/53) secured first rank with CGPA 9.67.
- SOMYA GUPTA (2K16/MC/79) secured second rank with CGPA 9.57.
- Third rank was secured by two students MANANLOHIA (2K16/MC/49) and RIDHIMA BANSAL (2K16/MC/64) with CGPA 9.52

Social Activities of the Department:

Apart from getting engaged in academic activities, the department also contributes towards the social responsibilities. In this regard, the department is organizing social events from time to time. In this academic year, due to COVID-19, the department extended its cooperation to the COVID-19 affected people by providing them food packets and medicines. Due to a lockdown in the country, the department was helpless in organizing its planned activities. Also, the faculty members felt that students were facing a lot of academic and emotional challenges due to the severe conditions of COVID-19. To address this issue, faculty members have extended their cooperation to the students not only to face their academic challenges but also mentored them to cope with their emotional stress.

Details of capability enhancement and development schemes organised by the Department: Department organised a few Short Term Training Programme (STTP) for the faculty members with the motivation to enable them technical education that may help to prepare students. STTP are listed below:

• Short Term Training Programme on "Recent Trends in Security and Cryptography" organized by Dr. Aditya Kaushik (Coordinator), Mr. Anshul Arora (Co-coordinator), Mr. Dhirendra Kumar (Co-coordinator), Ms. Sumedha Seniaray (Co-coordinator), Department of Applied Mathematics, Delhi Technological University sponsored by TEQIP-III

• Short Term Training Programme on"Graph Theory and its applications" organized by Prof. Anjana Gupta (Coordinator), Dr. C.P. Singh (Co-coordinator), Ms. Trasha Gupta (Co-coordinator), Ms. Payal (Co-coordinator), Department of Applied Mathematics, Delhi Technological University sponsored by TEQIP-III.

Placements: Due to the amalgamation of Mathematics, Finance and Computer Subjects, the students of Mathematics and Computing have always been in apple's eye for reputed companies and International Banks. The Placement report for the academic year 2019-20 is given below.

Established in year (2011), the Department of Applied Mathematics is a renowned centre offering B.Tech. in Mathematics & Computing Engineering. In the couple of years, the Department of Applied Mathematics, has grown expertise and competency in delivering science-based engineering curriculum. This year has witnessed some of the giant corporates offering coveted jobs across sectors and recruiting in large numbers, which was pivotal for the success of the placement season 2019-20. The placement season has seen recruiters from the entire spectrum of the industry like Engineering, Information Technology, Software programming, Research, Consulting, Finance, Banking and Services. The highest number of offers were rolled out by the Engineering and Technology sector. Students participated in the placement process from the Mathematics & Computing Branch. Students have received more than 70 offers from various tech giants like Microsoft, Samsung, Visa, American Express, Paytm and many more. This year the highest CTC rose to 43 LPA whereas the average CTC stood at 13.33 LPA. Students received a median CTC of 11.53 LPA.

Update of the infrastructure of the Department – Because of the continuous advancement of technical knowledge and to fulfil its requirement, the Department is having 3 computational labs with sophisticated instruments and software. Details of the laboratories owning by the Department are given below:

Lab Development: The Department of Applied Mathematics offers state-of-the-art computing facilities to all undergraduate and graduate students, research scholars, and faculty members. A high-speed Local Area Network

connection through the Institute and central facilities, ensure that all students and faculty have the most modern computing facilities, including round-the-clock internet and e-mail connection, to meet their academic and research needs. There are three computational Labs in the department equipped with the latest facilities. As of date, there are 110 systems in the Department laboratories for use. The systems have the following configuration:

Model : Dell Optiplex 9010 Processor: Intel (R) Core (TM) i7 3.4GHz RAM: 4.00 GB HDD : 512 GB OS : 32-bit Windows 7 Unit: 50	Model : Acer Veriton M4660G Processor: Intel (R) Core (TM) i7 8th Generation RAM: 16.00 GB HDD : 2 TB Unit: 30	Model : All in one HP systems 440G Processor: Intel (R) Core (TM) i7 RAM: 16.00 GB SSD : 512 GB Unit: 30

The computer systems are equipped with the latest software like C++, Java, Python, MATLAB, SPSS, MYSQL.

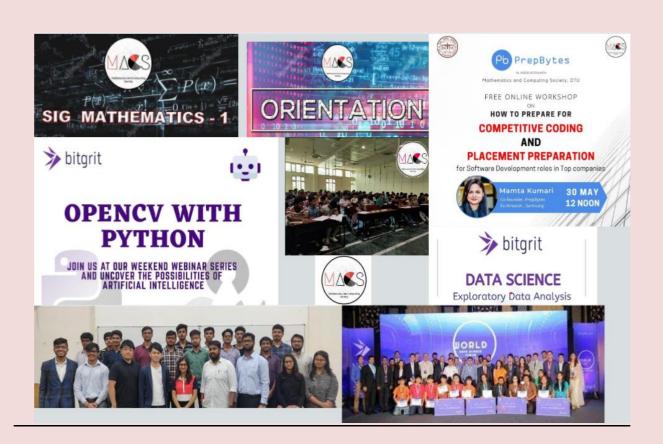## Extra-Curricular activities of the Department-

By keeping the all round development of the student in mind, the Department is offering two technical societies, namely, Mathematics and Computing Society (MACS) and Society of Industrial and Applied Mathematics (SIAM). These two societies are continuously conducting events for the benefit of the students. The events conducted by MACS are given below, while due to unforeseen situation of COVID-19, the events planned by SIAM had to be cancelled:

MACS acronym for Mathematics and Computing Society, MACS DTU, the Mathematics and Computing Society of Delhi Technological University is the tavern for the snollygosters and esurient for the profound knowledge of each domain belonging to Mathematics, Computing, Finance etc. The academic year 2019-2020 was no exception and MACS hosted various indigenous as well as extrinsic events.

Directed to introduce and inculcate the interest and the plenitude of perquisites that the discipline of mathematics and various scions of computing proffer.

1. **Orientation**: MACS DTU conducted its orientation on 16th October at Convocation Hall. This is the event which broadcasted the principles, functioning, exposure opportunity and structure of the society to the first-year and second-year students. Placed seniors from big-tech companies and final year students who have begged internships in Big-tech companies share their journey and importance of extra-curricular and overall holistic personality requirements for an MCE student.Students enjoyed the interactive discussion with seniors and understood the overview of the branch & its scope.

2. **Special Interest Groups - SIGs:** On 16th and 17th September, **Mr. Rishab Chaurasia**, SIG head & instructor at MACS delivered the conceptual overview and tips and techniques for Mid-sem preparation of MA101. A team of other 2nd year volunteers was also present during the SIG session, who helped in clearing all doubts of first year students. Once Again on 14th and 18th November, he delivered the conceptual overview and tips and techniques for End-sem preparation of MA101. These events attracted a raft of retainers and resulted in a good response by the attendees.

3. **AI and Blockchain lecture by Japanese Ambassador:** On 16th October, **MACS** at Delhi Technological University (DTU) delivered a series of lectures by Japanese ambassadors to develop bitgrit into a global platform that congregates data scientists and broadens the scope of services that we can contribute for the betterment of businesses and society. Bitgrit also selected 2 members from MACS as their Campus Ambassadors, who participated and represented DTU at **World Data Science Forum**.

4. **Data Science Competition in association with Bitgrit: MACS** in association with a Japanese partner organized an International Data Science Competition to test and train future data scientists. A total of $10,000 prize was distributed to winners and participants from all over the world.

5. **Exploratory Data Analysis Webinar by Bitgrit & MACS:** On 12th April, a Data Science Webinar was organized by MACS in association with a japanese company on **Exploratory Data Analysis** on Zoom, the overview and practical application of the technology was delivered to participants for free. A feedback session was also conducted after the Hands-on exercise.

6. **Webinar on OpenCV using Python:** On 17 May, MACS conduced a weekend Webinar in association with bitgrit to gear students with a hand-on experience of OpenCV using Python.

7. **Competitive Coding Webinar by PrepBytes:** On 30th May, PrepBytes in association with **Mathematics and Computing Society** of Delhi Technological University had organized an Online FREE WORKSHOP on "How to prepare for COMPETITIVE CODING and PLACEMENTS in IT & Software companies" This event included a LIVE CODING SESSION with industry experts from top global companies like Amazon and Samsung followed by Q&A session. This event attracted a raft of retainers and resulted in a good response by the attendees.

The Department is constantly encouraging its students to broaden their horizon and trying to bring the artistic capabilities in light. Some of the contributions from the Department are given below:

Article by Dr. Satyabrata Adhikari:

An Unforgettable Research: Beyond Noble Prize

Research inculcates scientific and inductive thinking and it promotes the development of logical habits of thinking and discipline. The definition of research is different for different people. One class of people aspire for research to get a research degree along with career benefits, another class do research to get recognition and respect and so on... Prof. Satyendra Nath Bose, who was born on 1st January 1894, Calcutta (now Kolkata), belonged to such a class of people who pursue research to get intellectual joy of doing creative work. He was a brilliant student since his childhood and secured first position in all examinations.

Satyendra Nath Bose is known for his contribution in quantum statistical mechanics. He collaborated with Albert Einstein to develop a theory on the distribution of identical and indistinguishable particles and later this groundbreaking research became popularly known as Bose-Einstein statistics. It describes one of the two possible ways in which a collection of non-interacting, indistinguishable particles may occupy a set of available discrete energy states at thermodynamic equilibrium. Prof. Bose didn't himself get the noble prize for this outstanding and unparallel work but later six noble prizes were awarded based on his work till date.

One day I got the opportunity to hear from Prof. Partha Ghose, who is a student of Prof. Satyendra Nath Bose. He was telling a short story about Prof. Bose. He told us that once he asked Prof. Bose that "You have discovered a class of particle which belongs to one of the two fundamental classes of subatomic particle, popularly known as Boson but you are not recognized for this

unforgettable research". Don't you regret for this? Prof. Bose replied instantly, No, not at all. The main thing is that the hidden thing has been discovered. Such a man was "Professor Satyendranath Bose".

<div align="right">

-Dr. Satyabrata Adhikari

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Poetry by Mr. Luckshay Batra:

जीवन की राह मुश्किल नहीं दोस्तों

जीवन तो ऐसे ही गुज़र जाना है

जिन लोगों को बातें बनानी है बनाने दो

एक दिन आखिर सबको अपनी पहचान छोडकर जाना है...

दुखी मत होना ये सोच कर

की आगे जिंदगी का सिलसिला क्या होगा

बस ये याद रखना के

अपनों की दुआओं का मज़ाक बना कर नहीं जाना है...