

National Workshop on Numerical optimization and its future perspectives

Under the Aegis of DBT Star College Program

(12th March – 16th March 2024)

REPORT

The Department of Mathematics of Deen Dayal Upadhyaya College, University of Delhi, organized a five days National Workshop on Numerical Optimization and its Future Perspectives during March 12-16, 2024. The workshop was funded by DBT Star College Program of Govt. of India. The purpose of this workshop was to bring together undergraduate students, expert, researchers, and practitioners in the field of numerical optimization to discuss recent advancements, challenges, and future directions. Optimization being a very important branch of modern applied mathematics used to solve problems in operations research, computer science, economics and various other fields.

The workshop focused on major aspects of optimization - theory, algorithms, and applications. The workshop featured a combination of lectures, interactive sessions, and hands-on sessions to facilitate knowledge sharing and skill development among the participants. There were two theoretical sessions daily followed by hands – on sessions with case studies covering the applications in various allied fields of sciences. Knowledge of these methods can be utilized at any platform to solve their own research problems in future and problems at their workplace. Based on the knowledge of theoretical sessions, participants were given multiple choice questions each day based on which they were graded at the end of the workshop and awarded prizes along with certificates.

The workshop commenced with an inaugural session where keynote speaker Prof. Ajay Arora provided an overview of the importance of numerical optimization in various fields such as engineering, computer science, finance, and healthcare. He highlighted recent trends and challenges in the field. Dr. Aparna and Dr. Amlendu Kumar gave basic knowledge of linear programming and its applications to the participants. Then hands – on session was conducted where participants learned about basics of mathematica and Tora software.

The second day focused on the fundamental concept of optimization, “initialization, iterations, and convergence”. Session 2 had the iterative techniques to obtain the numerical solutions for the system of equations using Gauss-Jacobi, Gauss-Seidel, and SOR (successive over-relaxation) methods. Participants engaged in these interactive sessions by

Dr. Brij Mohan to deepen their understanding of optimization principles and mathematical concepts underlying these algorithms.

Students also had an interactive session with one of our alumni, pursuing Post. Doc. from Germany. He presented his research work done in the area of optimization and interacted with the participants. The last session had a hands-on session for the methods and techniques discussed in both previous sessions on the system software Mathematica. These sessions helped the students to understand the concept of optimization and algorithms for these methods. With all these sessions, students can understand the numerical solutions and the relation of optimization of these solutions.

On day – 3, we had Prof. Prashant and Prof. Amber from the Department of Mechanical Engineering, IIT – Delhi. They explained Gradient descent algorithm that can be used to find optimal solutions to optimization problems that arise in a variety of applications such as healthcare, finance, logistics, manufacturing, cybersecurity, environment, etc. It is also widely used to optimize prediction error measures to train machine learning models and neural networks. They presented some versions of this algorithm in the context of a regression problem after working through some basic concepts of optimization." Real-world optimization problems were discussed, allowing participants to apply their theoretical knowledge to solve practical challenges.

On the fourth day, special sessions were dedicated to exploring advanced topics in numerical optimization by Prof. Suresh Chandra. He delivered his lecture on topics such as convex optimization, stochastic optimization, and multi-objective optimization. Participants had the opportunity to engage in discussions and share their research findings during interactive sessions.

On the final day, we had Prof. Sameer Anand from Department of Operational Research, University of Delhi who gave the concluding remarks summarizing the knowledge given to participants during previous four days. After that prizes and certificates were given in the presence of Prof. Manoj Saxena, Coordinator – DBT Star College Program, DDUC.

Organizing Committee Members:

Chairman – Prof. Hem Chand Jain, Officiating Principal, DDUC

Prof. Manoj Saxena – **Coordinator** – DBT Star College Program

Workshop Coordinators - Prof. Ratnesh Rajan Saxena, Dr. Poonam Garg, Dr. Mamta A. Wagh

Departmental Committee – Prof. Sanjay Kumar, Dr. Sudha Arora, Ms. Sunita Nadir, Ms. Paramjeet Kaur, Dr. Tarachand Prajapati, Dr. Rashmi Gupta, Dr. Aparna, Dr. Geeta.

Total Number of participants – 80

number of participants from dduc – 53

number of participants from other institutions – 27 (including 6 Ph.D. Scholars)

PRIZE WINNERS

| NAME | INSTITUTE | POSITION |
|-------------------|--|-----------------|
| Samiksha | Maitreyi College , D.U. | I |
| Maahir | Sri Guru Tegh Bahadur Khalsa College, D.U. | II |
| Diksha | Janki Devi Memorial College , D.U. | III |
| Dipansh Chaudhary | Sri Guru Tegh Bahadur Khalsa College, DU.. | CONSOLATION |
| AANCHAL CHANDEL | CHANDIGARH UNIVERSITY | CONSOLATION |
| Saikat | Rajdhani Collegez, D.U. | CONSOLATION |

Some pictures from the workshop –

















