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BOOK OF ABSTRACTS OF THE 2ND INTERNATIONAL CONFERENCE ON APPLIED MATHEMATICS AND COMPUTATIONAL SCIENCES (ICAMCS-2022)

ICAMCS 2022

Editors:

SEEMA YADAV

FATEH SINGH

JOGENDRA KUMAR

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Seema Yadav
Fateh Singh
Jogendra Kumar
(Editors)

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Editors

Dr Seema Yadav
Assistant Professor,
Department of Mathematics,
School of Physical Sciences,
DIT University, Dehradun

Dr Fateh Singh
Assistant Professor,
Department of Mathematics,
School of Physical Sciences,
DIT University, Dehradun

Dr Jogendra Kumar
Associate Professor,
Department of Mathematics,
School of Physical Sciences,
DIT University, Dehradun

Conference Organizer
DIT University, Uttarakhand, India
Conference Venue
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ICAMCS
2022

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Foreword

It is a great privilege for us to present the abstract book of ICAMCS-2022 to the authors and the delegates of the event. We hope that you will find it useful, valuable, aspiring, and inspiring. This book is a record of abstracts of the keynote talks, invited talks, and papers presented by the participants, which indicates the progress and state of development in research at the time of writing the research article. It is an invaluable asset to all researchers. The book provides a permanent record of this asset.

ICAMCS-2022 aimed to provide a platform to discuss ideas, issues, challenges, findings, opportunities, and applications of Applied Mathematics and Computational Sciences in various fields. The ever-changing scope and rapid development of science and technology create new problems and raise questions and curiosity, thus making it mandatory to share brilliant ideas and stimulate awareness of this vital research field in diverse directions. We promise to produce a bright picture and charming landscape for Mathematics with Computer Science. The overwhelming enthusiastic support received has truly exceeded our expectations. And thus, on the day of completion of this journey, we are delighted with a high level of satisfaction and aspiration.

The response to the call-for-papers had been overwhelming – both from India and overseas. More than 130 participants have been registered for the conference across the nation and abroad.

We are indebted to and extend our gratitude to the Chairs, Academic Advisors, and Technical Advisors whose support made the conference successful. We extend our gratitude to eminent guest speakers whose valuable ideas brought the conference to a higher level and made this conference meaningful and a great success.

We hope that all the participants of ICAMCS-2022 will have a wonderful and fruitful time at the conference.

Organizing Committee
ICAMCS-2022

About ICAMCS-2022

Mathematics is all around in nature and it is an integral part of everyday life, with applications ranging from investing money, predicting costs, and comprehending computers to building mathematical models of complicated problems and solving them using computational tools. Many new tools and approaches have been developed over time to solve a wide range of real-world problems that were previously difficult to solve analytically. Applied Mathematics and Computational Sciences is one such recent highly popular and well-known interdisciplinary field. The two subjects have applications in every field of science, engineering, technology, and industry, but combining them yields new powerful techniques. These techniques can solve problems in a variety of fields, such as finance, computing, insurance, industries, medical, research and development, public service, aircraft, automobile communication systems, biological-physical-mathematical & biomedical sciences, earth-atmosphere environmental sciences, and so on. This multidisciplinary field has expanded opportunities not only in humanities and creative arts, but in social sciences, archaeology, architecture, music, and the visual arts also.

In a nutshell, applied mathematics and computational sciences play a critical role in a wide range of interrelated areas and hence a review of the various aspects of the field, recent advancements, and achievement the need of the hour. The purpose of this International Conference is to provide:

- a global platform for research scholars, academicians, scientists, and industry people engaged in different fields of mathematics and computer science around the world, where the participants can interact and express their thoughts, challenges, recent developments, and innovative ideas in this rapidly growing field and can share their knowledge.
- a stage where experts will share their research findings, allowing participants to gain a comprehensive understanding of this interdisciplinary subject through various sessions of the conference, which will assist, guide, and motivate them, particularly young research scholars, to pave their path in this field.
- an exposure to participants of different regions and fostering interactions among them to facilitate their growth in the chosen research field.
- an interactive forum that may lead to an opportunity for new collaborations.

The conference will feature a keynote address, a number of plenary talks, invited lectures, contributory lectures and poster presentations.

About the Organizer

ABOUT DIT UNIVERSITY

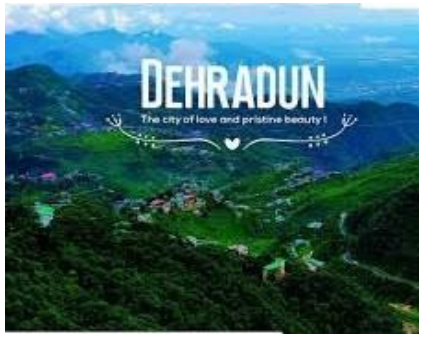
DIT was established in 1998 as Dehradun Institute of Technology by Unison Group, which later was given the status of an autonomous body in 2012 by UGC. Further, in 2013 it was conferred the status of university under act no. 10 of 2013 by Uttarakhand State Government and recognized by UGC under section 2(F) of UGC act 1956, due to its excellence in Education and Research. The University offers various programs at undergraduate and postgraduate level which includes Engineering, Pharmacy, Architecture, Management, Science, and Humanity & Liberal Arts Courses.

ABOUT MATHEMATICS DEPARTMENT

The Department of Mathematics was established at the inception of the Dehradun Institute of Technology in 1998 and was given an independent status in 2013 as the Department of Mathematics. The Department provides an outstanding research environment complemented by excellent teaching which facilitates the students to flourish in different areas of academics and industry. The department, equipped with highly qualified faculty, offers academic programs leading to the award of a Ph. D. degree. The thrust areas in which faculty members work are:

Special Functions, Numerical Analysis, Algebra, Coding Theory, Thermal Instability in Incompressible Fluids, Fuzzy Logic & applications, Optimization, Fluid Dynamics, Tensor Analysis, Cosmology, and Differential Geometry.

ABOUT THE CITY DEHRADUN



Nestled in the Doon Valley in the foothills of the great Himalayas and flanked by two very beautiful as well as mighty rivers the Ganges and the Yamuna on its eastern and western sides, Dehradun is one of the most ancient cities of India. Dehradun, the capital of Uttarakhand, got its name from the union of two words `Dera' and `Dun' which means Camp in the Valley.

Dehradun is a trendy hilly tourist destination with its impeccable beauty and charismatic sceneries. Along with tourist spots, a famous scientific museum, and lush green sprawling parks, Dehradun is adorned with several famous historic buildings that have great architectural value, and a number of temples that have spell-binding beauty and at the same time are considered to be very auspicious. The weather in Dehradun in the month of October remains pleasant with temperatures varying between 17^0C to 29^0C. The city also receives a good amount of snowfalls during winters which is a major attraction for tourists.

About the Editors

Dr. Seema Yadav did her post-graduation from HNB Garhwal University and Ph. D. from DIT University. She has over 17 years of academic experience in teaching in various programs viz. B. Tech, B.Sc., B. Pharm. She has publications in UGC listed and Scopus indexed journals and has attended and presented papers at international conferences. She has been an organizing member of various workshops organized by the department. Currently, she is working as an assistant professor in the Department of Mathematics, School of Physical Sciences, DIT University.

The area of research is Distributed Computing where different techniques of task allocation, using soft computing in a static environment, are more focused on. In addition to this, the other areas of interest include Numerical Analysis, Operations Research, Fuzzy Set Theory, and Soft Computing. She is more open and interested in making use of soft computing in optimization problems by exploiting numerical tools.

Dr. Fateh Singh is working as an Assistant Professor in the Department of Mathematics at DIT University, Dehradun. He completed his master's in Mathematics from CCS University Campus Meerut and received his Ph.D. in Mathematics from IIT Roorkee. He also qualified for CSIR-NET and GATE examinations in the years 2009 and 2010 respectively. Dr. Singh's research interests center on mathematical modeling, particularly Biomechanics and Epidemiology. He has visited Malaysia for attending international conferences. He has more than 11 Research Papers in the field of food science and technology and mathematical epidemiology, which have been published in various reputed SCI and Scopus journals and other indexed conference proceedings. He has attended many National and International Conferences, Seminars, and Workshops in

the field of mathematical modeling during his academic and research career. Currently, he is working in the area of mathematical epidemiology which is very popular for modeling and controlling of transmission of various infectious diseases in humans. He also has teaching experience of more than 7 years of teaching B. Tech and B.Sc. classes.

Dr. Jogendra Kumar is currently working as an Associate Professor in the Department of Mathematics, School of Physical sciences, DIT University, Dehradun. He has over 13 years of experience in Academia. He has completed his M. Sc. and Ph.D. from Banaras Hindu University Varanasi. His Ph. D. work was focused on the study of Thermal Instabilities in Incompressible Fluid saturated with Porous Media. He obtained his B. Sc. in Mathematics from K.N.P.G. Degree College, Gyanpur affiliated with V. B. S. Purvanchal University, Jaunpur.

Dr. Kumar has conducted several National and International conferences that have been funded by organizations such as SERB India, CSIR New Delhi, and UCOST Uttarakhand. He has also organized several workshops and training programs, including Basic Programming in Python in collaboration with FOSSEE Team, IIT Bombay; Faculty Development Program on SCILAB for Academics and Research in collaboration with IIT Bombay Spoken Tutorials, Mumbai; and National workshop on Theory, analysis of Differential Equation with MATLAB. Dr. Kumar has published several research articles (SCI/ESCI/SCOPUS) in peer-reviewed journals and has presented papers at National and International conferences.

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Message from Hon'ble Chancellor

It is a matter of pleasure that the Department of Mathematics, DIT University is organizing its 2nd Edition of the International Conference on Applied Mathematics and Computational Sciences (ICAMCS-2022) from 12th -14th October 2022.

This conference aims to unite the two parallelly moving areas – Applied Mathematics and Computational Sciences, which are in demand and an apt choice of the current time. Applied Mathematics marks the application of Mathematics in understanding problems of different domains and it is being supported by the computing capabilities of Computational Science to solve complex problems or phenomenon.

I believe this conference will provide a platform for academicians, scientists, industry personnel, researchers, and students to come forward to share their knowledge and ideas and may lead to some innovative collaborative work.

I welcome all to the conference and express my best wishes for a successful event.

Shri N. Ravi Shanker
Chancellor

Message from Hon'ble Vice–Chancellor

I am happy to note that the Department of Mathematics, DIT University is organizing the 2nd edition of the 'International Conference on Applied Mathematics and Computational Sciences (ICAMCS-2022)' during 12th-14th October 2022.

Applied Mathematics is a constantly growing field and involves the development of mathematical models for systems in Science, Engineering, Technology, and the Arts. In many domains, data analysis/modeling has become a game changer. A combination of elements of Mathematics, Statistics, Computer Science, and Information Technology has proven to be the way ahead for finding solutions to the challenges and problems faced by society. I congratulate the organizers of the conference and colleagues of the department who are making all efforts to make the conference a success.

I hope this conference provides the participants an opportunity to deliberate on current trends in the area and find ways to collaborate. I welcome the participants and wish them a fruitful time being part of the conference.

I wish the program all the success.

Prof. G. Raghurama
Vice Chancellor

Message from Hon'ble Pro Vice-Chancellor

I am delighted that the Department of Mathematics, DIT University is organizing the 2nd Edition of the conference entitled **"International Conference on Applied Mathematics and Computational Sciences (ICAMCS-2022)"** from 12th -14th October 2022. Heartiest congratulations to the organizers and the participants!

This year's conference is themed on "mathematical models of physical phenomena and complex problems" and it focuses on understanding and solving them using sophisticated computational techniques. Applied Mathematics helps in forming the models and Computational Science, as an important counterpart, deals with the computational aspects for higher performance and capability. It's a highly recognized and desired combination of domains and techniques. I hope the planned conglomeration of distinguished speakers will enrich and provide budding scholars with direction, inquisitiveness, and productive ideas to work on.

I hope the event will evoke rational, thoughtful discussions and encourage participants to work towards solving problems of social and global significance. I once again congratulate the organizers and all the members for their joint efforts and express my best wishes for the event.

Priyadarsan Patra
Distinguished Professor and Pro Vice-Chancellor

Message from Hon'ble Director STEAM

I am extremely delighted to know that the Department of Mathematics at DIT University Dehradun is organizing the 2nd edition of the **"International Conference on Applied Mathematics and Computational Sciences (ICAMCS-2022)"** from 12th to 14th October 2022.

This event shall witness participation from scientists and mathematicians working in the applied fields of mathematics and computational sciences. I am sure it will provide an engaging platform with a focus on having sequacious and prudent discussions, and information sharing amongst academicians, researchers, and students alike. I hope this forum will open new vistas for scholars and lead to development of novel mathematical and computational techniques, methods, and models with amalgamation of high-speed computing techniques, which have highly desired applications in different fields of Science, Engineering and Technology. The active participation of delegates and discussions of ideas and sharing of knowledge with distinguished speakers will also help and direct them to have joint collaborative research in the allied areas.

The success of a large-scale conference like this one requires commitment and contribution of many faculty members, student community and staff members. I would like to take this opportunity to express my deep sense of appreciation for the organizing committee members, who have put in their best efforts in the organization of this conference. I am sure this compendium of abstracts published herein would add to the conduit of knowledge in applied mathematics and computational sciences.

I hope and believe that this event will be beneficial for one and all.

I express my best wishes for the successful event.

Prof. Maneek Kumar
Director STEAM

Message from Chair ICAMCS-2022

It is an accomplishment to host the 2nd edition of the International Conference on Applied Mathematics and Computational Sciences (ICAMCS-22) at DIT University during October 12– 14, 2022. I commend the Department's academic members for their tireless efforts in making this conference a great success.

The primary purpose of the *Abstract Book* is to preserve records and make them accessible to researchers to update with the most recent advancements in their research areas. Mathematicians from India and overseas are urged to collaborate for better results in their joint research.

I appreciate the DIT University management's overall assistance and grant, which will go a long way toward making this conference a spectacular event.

Last but not the least, I really value the efforts put forth by Prof. Jogendra Kumar & Prof. Seema Yadav, Convener(s), ICAMCS-2022.

I hope the conference succeeds in accomplishing its goals.

Prof. Naresh M Chadha
Dean, School of Physical Sciences
DIT University

Message from Co-Chair ICAMCS-2022

It is a great accomplishment for the Department of Mathematics, DIT University to host the 2nd International Conference on Applied Mathematics and Computational Sciences (ICAMCS-2022) from October 12-14 in 2022.
This conference expresses the harmony of two distinct yet concurrently developing fields and offers academics and researchers a platform to interact and share knowledge, which is now necessary. I appreciate the hard work of the convener & co-convener to aim and bridge the gap between computational science and applied mathematics.
When adequate reason is upheld, this interdisciplinary domain becomes more and more significant in science and technology. I feel honoured to see that the Department of Mathematics at DIT University is continuously playing a significant role in promoting high-quality education, supporting research, and enhancing numerous programs linked to mathematics.

I sincerely hope that this conference will succeed in meeting its objectives.

Prof. (Dr.) Rakesh Mohan
Dean Student Welfare (DSW)
DIT University

Message from Convener ICAMCS-2022

I am delighted that DIT University, in all its splendour, will host the second edition of the International Conference on Applied Mathematics and Computational Sciences (ICAMCS-2022) during 12-14 October 2022. Researcher, faculty, and student networking and collaboration opportunities are provided by conferences by the publication of the findings in peer-reviewed journals and proceedings. Without a doubt, attendees of this conference will have the opportunity to network and learn new skills. This conference will surely help in the creation of new study paths at a time when the boundaries of knowledge are expanding at a faster rate.

There have been more high-quality submissions made to the conference on a consistent basis. The important building of the conference is the participation of prominent figures and scholars who are enthusiastic about delivering keynote addresses and taking part in panel discussions.

I thank all of the writers, reviewers, academic members at DITU, dignitaries, and management for their assistance in making this conference a success. Each and every attendee of the ICAMCS-2022 conference is expected to have a positive and unforgettable experience.

Last but not least, I would like to thank the American Institute of Physics (AIP), United States, for approving the publication of Conference Proceedings, as well as AIJR Publisher, India for publishing this Abstract Book as a monograph with an ISBN and DOI.

Dr. Jogendra Kumar
Convener
ICAMCS-2022

Acknowledgement

The editors and organizers of the 2nd edition of the International Conference on Applied Mathematics and Computational Sciences (ICAMCS2022) express their sincere thanks to the Management (DIT University), Honorable Chancellor, Shri N. Ravi Shanker (DIT University), Honorable Vice-Chancellor, Prof. G. Raghurama (DIT University), Honorable Pro-Vice-Chancellor, Prof. Priyadarsan Patra, Honorable Director STEAM, Prof. Maneek Kumar (DIT University), and Dean, School of Physical Sciences, Prof. Naresh M Chadha for their guidance and support to organize ICAMCS-2022.

We extend our heartfelt gratitude and sincere thanks to the keynote speakers Prof. O. D. Makinde (Stellenbosch University, South Africa), Prof. P. G. Siddheshwar (Formerly at Bangalore University, Bangalore), and Prof. Dumitru Baleanu (Cankaya University, Ankara, Turkey) for their plenary talks and contribution in the conference.

The organizers acknowledge the efforts of the eminent guest speakers of ICAMCS-2022: Prof. G. P. Raj Shekhar (IIT Kharagpur), Prof. R. C. Mittal (Formerly at IIT Roorkee), Prof. Ali Agkul (Siirt University, Yeni, Turkey), Dr. Kanchana (University of Tarapaca, Chile), Prof. Mahesha Narayana (The University of West Indies, Jamaica), Prof. Rajesh Pandey (IIT-BHU, Varanasi), Prof. Dharmendra Tripathi (NIT Uttarakhand), and Prof. Harendra Singh (P. G. College Ghazipur, U.P., India) for their contribution as an invited speaker in the conference.

We also would like express our sincere thanks to the Session Chairs of the conference Dr. Anupam Priydarshi (BHU, Varanasi), Dr. Amit Singh (REC, Ambedkar Nagar, U.P.), Dr. Triloki Nath (Dr. Hari Singh Gour University, Sagar, M.P.), Dr. Mukesh Awasthi (BBAU, Lucknow), Dr. Pankaj Kumar Mishra (Central University of South Bihar, Gaya, Bihar), Dr. Vineet Srivastava (REC Azamgargh, U.P.), Dr. Ziya Uddin (BML Munjal University, Gurugram), Dr. Om Suthar (MNIT Jaipur), Dr. Shilpi Agarwal (Mahatma Gandhi Government Arts College, Mahe, Pondicherry), Dr. Mahesh Bohra (Government Women Engg. College, Ajmer, Rajasthan), Dr. Ratnesh Mishra (NIT Jamshedpur, Jharkhand), Dr. Varun (Mahatma Gandhi Kashi Vidyapith, Varanasi), Dr. Manoj Kumar & Dr. Sag Ram Verma (Gurukul Kangri Vishwavidyalaya, Haridwar, Uttarakhand), Dr. Sacheendra Shukla (Amity University, Noida), Dr. Naveen Singhal, Dr. Vijay Kumar Jain, Dr. Parveen Kumar, Dr. Megha,

Dr. Manas Ranjan Dash, Dr. Sandeep Kumar Sharma, and Dr. Biplab Dhar from DIT University, Dehradun.

We would also like to extend our thanks to the moderator of the sessions Dr. Fateh Singh, Dr. Nitin Kamboj, and Dr. Biplab Dhar with the student volunteers (Mr. Naman Pokhriyal, Mr. Nilay Singh), Research Scholars (Ms. Shruti, Ms. Soniya, Mr. Pervinder), Publicity & Media head (Mr. Saurabh Arya), and Website Manager (Mr. Rohit) for their hard work and support during the preparation of the conference.

Last but not least, the organizers convey their gratitude to the management of DIT University for the financial support and aid. We also acknowledge our registered speakers and participants who cannot attend this conference due to anonymous reasons. We express our heartfelt thanks to each and every person who helped and supported the conference in one or the other way.

Dr. Jogendra Kumar, Dr. Seema Yadav

Convener(s) [ICAMCS-2022]

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