INDIAN MATHEMATICAL SOCIETY

INDIAN MATHEMATICAL SOCIETY

(Founded in 1907; Reg. No. S-550, Delhi)
Registered Office: Center for Advanced Study in Mathematics,
Savitribai Phule Pune University, Pune-411007
http://www.indianmathsociety.org.in

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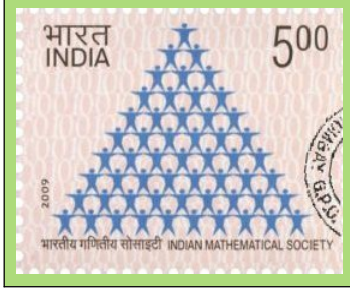
NEWSLETTER

NO. 41

March/April 2019



Facsimile of the Commemorative Postage Stamp on the 'Indian Mathematical Society' issued by the Department of Posts (Philately Division, Government of India, to mark the completion of hundred years of the Society. Released on the Inaugural day of the Platinum Jubilee 75th Annual Conference of the Society on 27th December 2009.

CONTENTS

IMPORTANT EVENTS

(1) The ensuing 85^{th} Annual Conference of the Society will be held under the auspices of The IIT Kharagpur, Kharagpur-721 302, West Bengal, during November 22-25, 2019 and Prof. G. P. Raja Sekhar, Department of Mathematics, IIT Kharagpur, will be the Local Organizing Secretary of the conference. His email id is ims2019@iitkgp.ac.in

(2) Prof. S. Arumugam, Department of Mathematics, Kalasalingam University, Anand Nagar, Krishnankoil (TN) has been selected as the President of the Indian Mathematical Society for a period of one year with effect from April 1, 2019.

(3) Prof. Nita Shah (Ahmedabad), Prof. Ahmed Ali (Lucknow) and Prof. S. Sreenadh (Tirupati) have been elected unopposed as members of the Council for a period of three years with effect from April 1, 2019.

(4) Prof. S. K. Nimbhorkar is elected unopposed as the President of the Section of Mathematics (including Statistics) for 107^{th} Annual Session of Indian Science Congress that will be held at University of Agricultural Sciences, GKVK Campus, Bangalore, Karnataka from 3^{rd} to 7^{th}January, 2020.

(5) Prof. S. S. Shrikhande is notable for his breakthrough work (joint work with R. C. Bose and E.T. Parker) of disproof of the famous conjecture made by Euler that there do not exist two mutually orthogonal latin squares of order $4n + 2$ for any n. Prof. S. S. Skrikhande who is a life member of IMS is 102 years old now, IMS pays respects to him.

(6) Prof. Katherine Johnson is an African-American mathematician whose calculations of orbital mechanics as a NASA employee were critical to the success of the first and subsequent U.S. manned spaceflights. Prof. Katherine Johnson completed 100 years now, IMS pays respects to her.

(7) Prof. A. K. Agarwal Award for the paper published in the year 2017 has not been awarded to anyone as no paper received for the award satisfied the terms and conditions for giving the award.

(8) Only one paper was received for Prof. A. M. Mathai Award for the paper published in the year 2017. However, the paper did not meet the conditions formulated to give the award and therefore the award is not given to anyone.

(9) Prof. Satish Bhatnagar Award for the paper published in the year 2017 has been awarded to Prof. Amartya Kumar Datta for his paper "Weighted Arithmetic Mean in Ancient India", BhAvanA 1(4) (2017), pp. 24-36.

(10) P. L. Bhatnagar Memorial Prize for 2018 is given to Pranjal Srivastava of National Public School, Koramangala, Bengaluru. The 59th International Mathematical Olympiad (IMO) was held in Cluj Napoca, Romania during July 4-14, 2018. In the Indian team Pranjal Srivastava was the top scorer (28 points) at IMO.

(11) A. Narasinga Rao Memorial Prize for the year 2017 has not been awarded to anyone since no paper under consideration was up to the mark.

(12) The Volumes 84 (2017) and 85 (2018) of JIMS have been published online on the website of the Informatics publishing Limited, Bangalore. These volumes have been uploaded on the Informatics India's I-scholar platform.

(13) The last date for submitting papers for Prof. A. K. Agarwal Award, Prof. A. M. Mathai Award and Prof. Satish Bhatnagar Award for the paper published in the year 2019 is June 30, 2019. The details are available on www.indianmathsociety.org.in.

HIGHLIGHTS OF THE 84^{th} ANNUAL CONFERENCE OF THE IMS

The 84^{th} Annual Conference of the Indian Mathematical Society was held at the Department of Mathematics, Shri Mata Vaishno Devi University (SMVDU), Katra during November 27-30, 2018 under the president-ship of Prof. Sudhir Ghorpade, Department of Mathematics, IIT, Mumbai. The Conference was attended by more than 200 delegates. Two presidential addresses (General and Technical), two plenary talks by Prof Steven Dale Cutkosky, University of Missouri and Prof M Vanninathan, IIT Bombay, Mumbai, four Memorial Award lectures and six invited lectures were delivered in the conference. Also, six symposia were organized during the conference and twenty three invited speakers gave talks in the symposia. Along with these symposia, poster sessions were also organized and in all six posters were displayed - four in the symposium on 'Commutative Algebra and Algebraic Geometry' and one each in the symposium on 'Theory and Numerics of Evolution Equations' and 'Harmonic Analysis and Related Topics'. Moreover, in all 122 research papers were accepted for presentation at the Conference including 8 research papers for the paper presentation competition for various prizes.

The Conference was inaugurated by Prof. Sanjeev Jain, Hon'able Vice-Chancellor of Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir. The function was presided over by Prof. Sudhir Ghorpade. Prof. A. K. Das, Head, School of Mathematics and Local Organizing Secretary of the Conference welcomed the delegates. The General Secretary of IMS, Prof. N. K. Thakare spoke about the Indian Mathematical Society and on behalf of the Society expressed his sincere and profuse thanks to the host for organizing the Conference. Prof. Peeyush Chandra, Academic Secretary of IMS, reported the academic programmes of the Conference.

Prof. Sudhir Ghorpade delivered his Presidential address (General) on The role of history in learning and teaching Mathematics: A personal perspective. The function ended with a vote of thanks by the Local Organizing Secretary.

Prof. Sudhir Ghorpade gave Presidential address (Technical) on "Wonderful world of finite fields" which was presided over by Prof. N. K. Thakare, General Secretary of the Indian Mathematical Society.

Prof. Steven Dale Cutkosky, University of Missouri gave a **plenary talk** on Resolution of Singularities and Local Uniformization.

Prof. M. Vanninathan, IIT Bombay, Mumbai gave a **plenary talk** on Calculus of Variations and Applications.

The 32^{st} **P. L. Bhatnagar Memorial Award Lecture** was delivered by Prof Manoranjan Mishra, IIT Ropar, Rupnagar, Punjab on Hydrodynamic Instabilities in Porous Media Flows.

The 29^{th} **V. Ramaswami Aiyar Memorial Award Lecture** was delivered by Prof K. N. Raghavan, I M Sc, Chennai on Symmetric Functions.

The 29^{th} **Srinivasa Ramanujan Memorial Award Lecture** was delivered Prof. Nayandeep Deka Baruah, Tezpur University, on Some Partition Identities Analogous to Ramanujan's "Most Beautiful Identity".

The 29^{th} **Hansraj Gupta Memorial Award Lecture** was delivered by Prof S. S. Khare, NEHU, Shillong on "Trends in bordism, cobordism theory and fixed

point set: A survey"

Apart from this **Satish Bhatnagar Award Lecture** was delivered by Prof Amartya K Dutta, ISI Kolkata on Skype as Prof Dutta could not come personally. Skype talk was the first time experience at IMS meeting and was successful.

Prof. A. K. Agarwal Award for the year 2017 has not been awarded to anyone as no paper received for the award satisfied the terms and conditions for giving the award.

Only one paper was received for Prof. A. M. Mathai Award for the year 2017. However, the paper did not meet the conditions formulated to give the award and therefore the award is not given to anyone.

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A. Narasinga Rao Memorial Prize for the year 2017 has not been awarded to anyone since no paper under consideration was up to the mark.

Various prizes for the Paper Presentation Competition:

For the IMS prizes 8 papers were received : one in Group 2. two in Group 4 and five for V M Shah Prize. No paper was received for Groups 1,3,4,5 and AMU prize. The papers were presented in the competition section.

Following is the result for the award of these prizes.

IMS Prize - Group-1: No paper was received in this group.

IMS Prize - Group-2: One paper was received. prize was awarded to Radhika Vasisht, Department of Mathematics, University of Delhi, Delhi.

IMS Prize - Group-3: No paper was received in this group.

IMS Prize - Group-4: Two papers were received and presented. However, the prize was not given to any one.

IMS Prize - Group-5: No paper was received in this group.

AMU Prize: No paper was received in this group.

V M Shah Prize: Five papers were received and presented. The prize is awarded to Garima Tomar, Department of Mathematics, Central University of Haryana, Haryana.

Invited Lectures delivered
Half hour Talks

1. Dona Strauss, University of Leeds, England - Subsets of βN which are not Borel

2. H. Garth Dales, University of Lancaster, England - Maximal left ideals in Banach algebras

3. H. S. Ramane, Department of Mathematics, Karnatak University, Dharwad, India - Equienergetic Graphs

4. A. K. Misra, Department of Mathematics, Institute of Science, Banaras Hindu University, India - Controlling the Atmospheric Level of Carbon Dioxide to Mitigate Global Warming: A Modeling Study

5. Indranath Sengupta, Discipline of Mathematics, IIT Gandhinagar, Palaj, Gandhinagar, India - Numerical Semigroups and Affine Curves

6. K. S. Charak, Department of Mathematics, University of Jammu, Jammu, India - Baker's Conjecture on Permutable Entire Function

Symposia organized

Six symposia were organized and the details are as follows.

1. Harmonic Analysis and Related Areas
Speakers : Professors M. Filali, A. Taheri, H. Garth Dales, Riddhi Shah (convenor)
It may noted that Prof Ajit Iqbal Singh had been instrumental in organizing this symposium but could not be present due to illness and Prof Riddhi Shah was requested to be the convenor of this symposium.

2. Commutative Algebra and Algebraic Geometry
Speakers : Professors J. K. Verma, Hema Srinivasan, Chanchal Kumar, M Manjunath - Prof Sudhir Ghorpade acted as the convenor as Prof Amartya Kumar Dutta could not come due to some pressing reasons in the family.

3. Theory and Numerics of Evolution Equations
Speakers : Professors Shruti Dubey, Shuvan Sen, Ritesh K. Dubey (Convenor)

4. Coding Theory and Cryptography
Speakers : Professors Trygve Johnson, Manish Gupta, Sartaj Ul Hasan, Madhu Raka (Convenor)

5. Operator Theory and Topology
Speakers : Professors Ajay Kumar, M. Mursaleen, S. S. Khare, Anima Nagar, Pankaj Jain, Convenor - Prof S. D. Sharma

6. Special Functions and Transforms Methods
Speakers : A. Sairam. R. K. Jana, Syed Abbas (convenor)

MINUTES OF THE 84^{th} ANNUAL GENERAL BODY MEETING OF THE INDIAN MATHEMATICAL SOCIETY

The 84^{th} Annual General Body Meeting of the Indian Mathematical Society was held on Friday, the 30^{th} November, 2018 at 12 noon in the Meeting Hall of Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir under the presidentship of Prof. Sudhir Ghorpade.

The following business was transacted.

Item No. 1: To confirm the Minutes of the General Body meeting held on Friday, the 15th December, 2017 at 12 noon in the Lecture Hall of the Department of Mathematics, Sri Venkateswara University, Tirupati (A. P.) under the presidentship of Prof. Manjul Gupta.

The Minutes of the General Body meeting held on December 15, 2017 at 12 noon at Sri Venkateswara University, Tirupati (A. P.) were conrmed.

Item No. 2 : To receive the report of the General secretary for the year 2018. Report of the General Secretary for the year 2018. To receive the report of the General secretary for the year 2017.

Report of the General Secretary for the year 2018.

1. The IMS News Letters No. 39 and No. 40 were published in March 2018 and in August 2018, respectively. These are also displayed on the website of the Indian Mathematical Society. The soft copies of these News Letters have been sent by e-mails to all the members of the Society.

Prof. Sudhir Ghorpade, IIT, Mumbai was informed that he has been elected as the president of IMS for one year with effect from April 1, 2018.

2. The meeting of the Academic Planning Committee for the IMS Conference 2018 was held on Sunday, the 10^{th} June, 2018 from 11.00 a.m. to 1.00 p.m. in the conference room of the Guest House of the Savitribai Phule Pune University, Pune. The meeting was presided over by Prof. Sudhir Ghorpade, the president of the IMS The names of the speakers for the four memorial award lectures, plenary talks, invited talks, list of symposia and their conveners were finalized in the meeting.

3. A. Narasinga Rao Memorial Prize for the year 2017 has not been awarded to anyone since no paper under consideration was up to the mark.

4. Prof. A. K. Agarwal Award for the year 2017 has not been awarded to anyone as no paper received for the award satisfied the terms and conditions for giving the award.

5. Only one paper was received for Prof. A. M. Mathai Award for the year 2017. However, the paper did not meet the conditions formulated to give the award and therefore the award is not given to anyone.

6. Prof. Satish Bhatnagar Award for the year 2017 has been awarded to Prof. Amartya Kumar Datta for his paper Weighted Arithmetic Mean in Ancient India published in BhAvanA 1(4) (2017), pp. 24-36.

7. P. L. Bhatnagar Memorial Prize for 2018 is given to Pranjal Srivastava of National Public School, Koramangala, Bengaluru. The 59th International Mathematical Olympiad (IMO) was held in Cluj Napoca, Romania during July 4-14, 2018. In the Indian team Pranjal Srivastava was the top scorer (28 points) at IMO.

8. Digitization of the back volumes of JIMS published from the year 1976 to the

year 2005 have been completed by the Informatics Publishing Ltd., Bangalore. The digitized volumes are available online. These volumes were retrieved from the IMS Library housed at Ramanujan Institute for Advanced Study in Mathematics, Madras University, Chennai.

9. During the year of the report 124 new life members of IMS have been enrolled, besides 56 persons became sessional members of the IMS for 2018 conference.

10. A timely guidance and the help has been provided to Prof. A. K. Das, Local organizing secretary of the 2018 IMS conference-An International Meet pertaining to raising of funds, local arrangements and inaugural function of the conference.

11. Each Life Member of the Society is now allotted a Permanent Membership Number. The complete list of Life Members of the Society is now available on the IMS website.

12. The complete catalogue of the back volumes of the periodicals published by the Society as well as those received in exchange by the Society and available in the IMS Library, Chennai is now available on the IMS website.

13. The General Secretary thanks Prof. J. R. Patadia for maintaining and updating the website of the IMS.

14. The General Secretary thanks Prof. M. M. Shikare and Prof. S. K. Nimbhorkar for extending substantial help in performing the duties of the general secretary.

Item No. 3 : To receive the Report of the Academic Secretary 2018.

Based on the deliberations during the APC meeting held on June 10, 2018 at SP Pune University, Pune and subsequent consultations with the President and the General Secretary, the following speakers have been finalized and letters of invitation were sent to the following:

Memorial Award Lectures

1. 32^{nd} P. L. Bhatnagar Memorial award lecture: Dr Manoranjan Mishra, IIT Ropanagar
2. 29^{th} Hansraj Gupta Memorial award lecture: Prof S. S. Khare, NEHU, Shilong
3. 29^{th} Srinivasa Ramanujan Memorial award lecture: Prof N Deka Baruah - Tezpur University
4. 29^{th} V. Ramaswamy Aiyer Memorial award lecture: Prof K. N. Raghavan, IMSc Chennai

Plenary Talks:

Prof Steven Dale Cutkosky, Univ of Missouri, USA
Prof M Vanninathan, IIT Bombay, Mumbai.

Satish Bhatnagar Award Lecture Speaker: Dr Amartya K Dutta, ISI Kolkata

Invited Speakers for Half an hour talks:

Prof H S Ramane, Karnatak Univ. Dharwad
Prof H.G. Dales. UK
Prof D. Staruss, UK
Prof A K Mishra, BHU, Varanasi
Prof K S Charak, Jammu University
Prof Indranath Sengupta, IIT Gandhinagar

Following symposia were finalized with conveners as mentioned below:

(i) Harmonic Analysis and Related Areas- Prof Ajit Iqbal Singh, New Delhi and Prof. Rudra Sarkar, ISI Kolkata

(ii) Theory and Numerics of Evolution Equations - Dr Ritesh Kumar Dubey, SRM Institute of Science and Technology, Chennai

(iii) Coding Theory and Cryptography - Prof Madhu Raka Punjab University, Chandigarh

(iv) Commutative Algebra and Algebraic Geometry - Prof Amartya Kumar Dutta, ISI Kolkata

(v) Operator Theory and Topology Prof S. D. Sharma, Central Univ of Jammu

(vi) Special Functions and Transforms Methods Prof Jugal K. Prajapati, CUR, Kishangarh

The Conveners for various symposia have finalized the speakers in consultation with Academic Secretary. The final list is given below:

Commutative Algebra and Algebraic Geometry: Speakers: Professors J. K. Verma, Hema Srinivasan, Chanchal Kumar, Neena Gupta, M Manjunath.

Special Functions and Transforms Methods : Speakers: Professors A. K. Agarwal, A. Swaminathan, Shubhi Khan, A. Sairam. Syed Abbas, J. K. Prajapat

Theory and Numerics of Evolution equations: Speakers: Professors Shruti Dubey, Ismail Farzad, N. Kishore Kumar, Shuvan Sen, Ritesh K. Dubey

Harmonic Analysis and Related Areas: Speakers: Professors M. Filali, A. Taheri, H. Garth Dales, Riddhi Shah, Rudra Sarkar

Operator Theory and Topology: Speakers: Professors Ajay Kumar, M. Mursaleen, SS Khare, Anima Nagar, Pankaj Jain

Coding Theory and Cryptography: Speakers: Professors Mahesh Anand, Trygve Johnson, Manish Gupta, Sartaj Ul Hasan, Madhu Raka.

This year total of 137 papers have been received out of which 8 papers are for Prizes (5 for V M Shah prize, 1 for Gr 2 and 2 for Gr 4), 7 for Poster Presentation and 122 as Contributory presentations.

Item No. 4: To receive the report of the Administrative Secretary for the year 2018.
Report of the Administrative Secretary for the year 2018.

1. E-mails of thanks and appreciations were sent to the local organizing secretary of 83rd Annual Conference of IMS held in December 2017 at Sri Venkateswara University,Tirupati(A. P.). Elected council members were informed of their elections as members of the IMS council.

2. The Minutes of the Council Meeting and the General Body meeting held at Sri Venkateswara University,Tirupati(A. P.) were prepared.

3. Arrangements were made for holding the meeting of the Academic Planning Committee on Sunday, the 10th June 2018 from 11.00 am onwards in the conference room of the Guest House of the Savitribai Phule Pune University, Pune (SPPU). Local Hospitality and travel arrangements were made for the delegates attending the meeting.

4. The print copies of JIMS Volume 85, nos. 1-2 (January June 2018) and JIMS Volume 85, nos. 3-4 (July Dec. 2018) were received from Parashuram Process,

Pune and preserved in the Library of the Mathematics Department, Savitribai Phule Pune University, Pune. The camera ready copies of The Math. Student, Vol. 87 (1-2), 2018, and The Math. Student, Vol. 87 (3-4), 2018 were forwarded to the Parshuram Process for the purpose of printing. The printed copies have been received from the press and preserved in the Library of Math. Deptt., SSPU.

5. The copies of JIMS Vol. 85 (Nos. 1-2) (2018), Vol. 85 (Nos. 3-4)(2018) and The Mathematics Student Vol. 87 (Nos. 1-2) (2018) have been sent to the subscribing institutes and Universities by registered post. The account of corresponding expenses has been maintained.

6. The Informatics Publishing Ltd., Bangalore was requested to speed up the digitization of JIMS volumes which were made available by Ramanujan Institute for Advanced Study in Mathematics, University of Madras, Chennai; and also give proposals for digitization of back volumes of The Mathematics Student, and distribution of old volumes of JIMS and The Mathematics Student lying in the IMS Library, Chennai.

7. Substantial help was rendered to the General Secretary Prof. N. K. Thakare in the finalization of IMS Newsletter Nos. 39 and 40. The Newsletters were prepared; and sent by e-mails to the Life members of the IMS in cooperation with Prof. Patadia.

8. Assistance was provided to the General Secretary in handling various matters related to Prof. A. K. Agarwal award, Prof. A. M. Mathai award, A. Narsinga Rao memeorial prize, and Prof. Satish Bhatnagar award for the year 2017.

9. The records / documents such as minutes of the council meeting, minutes of the general body meeting, copies of the News Letters, copies of agenda for council meeting and General body meeting have been maintained.

Item No. 5: To consider the Audited Statement of Accounts for the year 2017 -2018 and budget for the year 2019- 2020.

The Audited Statement of Accounts for the year 2017- 2018 and budget for the year 2019- 2020 presented by the Treasurer, Prof. S. K. Nimbhorkar were approved.

Item No. 6: To receive the report of the Editor, The Journal of the Indian Mathematical Society for 2018. Report of the Editor, The Journal of the Indian Mathematical Society for 2018.

Manuscript Status:

(a) Number of papers pending with the referee or under process at the end of 2017: 30
(b) Number of manuscripts received during the year 2017: 103
Total: 133
(i) Number of Manuscript accepted during 2018: 33
(ii) Number of manuscript rejected during 2018 : 80
(ii) Number of manuscript with the referees / under process: 20
Total: 133

Digitization of the back-volumes of JIMS: The Informatics Private Ltd (IPL) has already digitized and put a large number of back volumes of the JIMS on line. The volumes available at the Pune University have been digitized.The remaining volumes are being procured from our Chennai library and given to the IPL for completing the full digitization work of the JIMS from 1907 onwards.

Publication Status (online by the IPL):

(a) Volume 85(1-2) 2018 of the JIMS published on Jan 1, 2018.
(b) Volume 85(3-4) 2018 of the JIMS published on July 1, 2018
(c) Volume 86(1-2) 2019 of the JIMS published in Nov 2018.

Publication Status (Print by the IMS)
(a) Volume 85(1-2) 2018 of the JIMS was published in Feb, 2018 and sent to the subscribers by the Administrative Secretary, IMS
(b) Volume 85(3-4)2018 of the JIMS was published in September 2018 and then sent to the subscribers by the Administrative Secretary, IMS.
(c) Volume 86(1-2) 2019 of the JIMS will be published in Dec-Jan 2018 and sent to the subscribers soon.

Acknowledgements:
The Chief Editor, JIMS expresses his sincere thanks to numerous referees and the members of the Editorial Board, JIMS, specially Prof Peeyush Chandra and Prof Ravi Agarwal, for their help in refereeing and/or processing the manuscripts received for JIMS. He also records his sincere thanks to Profs S.K.Nimbhorkar and M. M. Shikare for extending all possible help in printing and dispatching copies of the JIMS to the subscribers of the Journal.

Item No. 7: To receive the report of the Editor, The Mathematics Student for 2018. Report of the Editor, The Mathematics Student for 2018.

Publication Status:

The soft copy of the Vol. 87, Nos. 1- 2, January-June (2018) of The Mathematics Student was sent on line in June 2017 and that of the Vol. 87, Nos. 3-4, July-December (2018) of The Mathematics Student was sent on line during November 2-10, 2018 to all the Life Members (who have registered their E-mail id on line on imsgoesgreen@gmail.com or jamanadaspat@gmail.com or sknimbhorkar@gmail.com) at their registered E-mail addresses. Both these soft copies are available on the Society's website as well.

There is no backlog as regards to the publication of the Mathematics Student.

Manuscript Status:

65 manuscripts are received during the period from December 09, 2017 to November 20, 20187 and 10 manuscripts were reported as pending with the referees in the last report.

Of these total 75 manuscripts, 19 are accepted, 45 are not accepted and 11 are pending with the referees.

Acknowledgements:

We take this opportunity to put on record our sincere thanks and profuse gratefulness to the Members of the Editorial Board and the learned referees for their continuous support and assistance in our sustained efforts for timely publication of the Mathematics Student. The Society looks forward to the active assistance in the constructive reviewing work as well as quality contributions from the large pool of mathematicians from India and abroad.

We started Problem Section from 2015 and it is going on successfully. During these three years support has come from Editorial Board Members as well as from the floor. We have very broad and sustained participation from Satya Deo, C. S. Aravinda, George E. Andrews, Kannappan Sampath, M. Ram Murty, Atul Dixit, Amritanshu Prasad, Ashay Burungale, Abhijin Adiga, B. Sury, Mahender Singh, Mathew Francis, L. Sunil Chandran, Amrik Singh Nimbran, Raja Sridharan,

Purushottam Rath, Clare D'Cruz, S. K. Tomar, Emeric Deutsch, Aritro Pathak, Zoltan Boros, Arpad Szasz and N. Tejaswi. We express our special thanks to all these colleagues, in particular to B. Sury from ISI, Bangalore who almost single handedly manages the problems and solutions every years.

Express our special thanks to th colleagues in particular Prof. B. Sury, as well as colleagues from the floor who took part in our Problem Section since we began it in 2015 and made it a success.

We also express our sincere thanks to the Administrative Secretary Prof. M. M. Shikare and the Pune Press for their assistance in getting the Vol. 87, Nos. 1-2, January-June (2018) as well as the Vol. 87, Nos. 3-4, July-December (2018) of the Mathematics Student printed, and thus in its timely publication.

Call for contributions: Contributions are welcome and are assured of all the sincere efforts for prompt processing.

Item No. 8: To consider the venue of the 85th Annual session of the Society to be held in December 2019.

The Council accepted the firm invitation from the Director, Indian Institute of Technology, Kharagpur, U. P. for organizing the 85th Annual Conference of the Indian Mathematical Society. So the 85th Annual Conference of the IMS will be held at IIT, Kharagpur. Prof. G. P. Raja Sekhar, Head, Department of Mathematics, IIT, Kharagpur will be the Local Organizing Secretary of the conference.

Item No. 9: To receive the report of the Returning officer concerning results of the elections.

Returning officer's Report:

The Council of the Indian Mathematical Society (IMS), at its meeting held in December 2017 at Shri Venkateshwara University, Tirupati, made the following nominations to the various offices of the Society and to the Council of the IMS.

To the Office of the President: The Council nominated Prof. Rajendra Bhatia of Ashoka University, Delhi for election to the Office of the President of the Society for one year with effect from01-04-2019. No other nomination was received from the floor for election to the office of the President. Thereforeno election was held and Prof. Rajendra Bhatia is declared elected unopposed to the office of the President of IMS for one year with effect from April 01, 2019. Because of Prof. Bhatia's unavailability the Council has selected and selected Prof. S. Arumugam (Adjunct Professor, Department of Mathematics, Amrita Vishwa Vidyapeetham, Coimbatore) as the President of the IMS for one year starting from April 1, 2019.

Election of the Office bearers of the IMS, other than the President:
The Council made the following nominations for election to the various Offices the Society, other than that of the President, for three years with effect from April 01, 2019.

(i) For the office the General Secretary : Prof. Satya Deo
(ii) For the office the Academic Secretary : Prof. Peeyush Chandra
(iii) For the office the Editor, JIMS : Prof. Sudhir Ghorpade
(iv) For the office the Editor, The Mathematics Student : Prof. M. M. Shikare
(v) For the office the Treasurer : Prof. S. K. Nimbhorkar

No other nominations were received from the floor for election to any of the above

offices of the Society and therefore no elections were held and the above mathematicians are declared elected unopposed to the respective office of the Society for three years with effect from April 1, 2019.

Election of members to the Council of the Society.

The Council made the following nominations as members of the Council of the Society for three years with effect from April 01, 2019.

1. Prof. Nita Shah (Ahmedabad)
2. Prof. Ahmed Ali (Lucknow)
3. Prof. S. Sreenadh (Tirupati)

No other nominations were received from the floor for election to the Council of the Society and therefore no elections were held and the above mathematicians are declared elected unopposed to the Council of the Society for three years with effect from April 1, 2019. The council has appointed Prof. B. N. Waphare, Savitribai Phule Pune University, Pune as the Administrative Secretory of IMS for the year with effect from April 1, 2019.

Item 10. Any other item with the permission of the chair.

No other item was under consideration.

The efforts put in by the Local organizing Secretary Prof. A. K. Das, his colleagues and the University administration for successful organization of the conference were appreciated by the office bearers and the members of the IMS.

The Meeting ended with a vote of thanks to the President of IMS, the members present, Prof. A. K. Das, his colleagues and the University administration.

Satya Deo
General Secretary
Indian Mathematical Society

Memorial Award Lectures

During every Annual Conference of the Society, the following Memorial Award Lectures are arranged as a part of the Academic Programme (each award lecture is of one hour duration with no other parallel session) :

(1) P. L. Bhatnagar Memorial Award Lecture (Instituted in 1987).
(2) Srinivasa Ramanujan Memorial Award Lecture (Instituted in 1990).
(3) V. Ramaswamy Aiyer Memorial Award Lecture (Instituted in 1990).
(4) Hansaraj Gupta Memorial Award Lecture (Instituted in 1990).
(5) Ganesh Prasad Memorial Award Lecture (Instituted in 1993 ; and delivered every alternate year).

Each of these Lectures carry a token honorarium of Rs. 5000/- along with a citation.

Members of the Society are requested to suggest the names of the prospective speakers, along with their brief write-up, for these awards. The suggestions may be sent to Professor Satya Deo, the General Secretary of the Indian Mathematical Society up to May 31, 2019. His e-mail address is sdeo94@gmail.com

IMS Sponsored Lectures

To popularize mathematics and to create awareness regarding the Society and its activities in the Country, the Society has a Scheme of **Sponsored Lectures**. It

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Prof. Ravi Kulkarni has also donated Rs. 1,25,000/- to organize **Meenakshisundaram–Patoudi lectures**.

Members arranging such lectures are required to send the report of the arranged lectures to The Treasurer, IMS, with a copy to The Editor, `The Mathematics Student`.

Society intends to enhance this activity of organizing such lectures at more and more centers. Members desirous to organize such lectures at their centers may write to the General Secretary Prof. Satya Deo through their respective Head of the Department.

Periodicals published by the Society

The Society publishes two periodicals: `The Journal of the Indian Mathematical Society` (JIMS; the Journal; ISSN 0019-5839) and **The Mathematics Student** (Math Student; the Mathematics Student; ISSN 0025-5742), both of which are quarterly. The details can be found on the website: www.indianmathsociety.org.in

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It may please be noted that the contents of `The Mathematics Student` will continue to be available on the Society's website www.indianmathsociety.org and a physical copy of `The Mathematics Student` will continue to be available at the IMS Library (Ramanujan Institute of Advanced Study in Mathematics, Madras University, Chennai) as well as at the Registered Office of the Society (Department of Mathematics, S. P. Pune University, Pune 411 007) for reference during office hours.

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All business correspondence be addressed to Prof. S. K. Nimbhorkar, Treasurer, IMS; Department of Mathematics, Dr. B. A. M. University, Aurangabad 431 004 (Maharashtra), India. All payments should be sent to Prof. S. K. Nimbhorkar, Treasurer, IMS by DD / payable at par cheque drawn in favor of **"The Indian Mathematical Society"** payable at **Aurangabad** (Maharashtra), India at the address mentioned in the above.

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A member is considered to be of good standing in a particular year if he/she has paid his/her Membership dues by **July 31**st of that year.

IMS Library:
The information pertaining to IMS library is available on the website www.indianmathsociety.org.in of the society.

Guidelines for acceptance of Donations to the Society:

There will not be any further institution of Memorial Award Lectures. (This point was discussed in the earlier meetings of the Council and such was the consensus).

The donation amount will not be less than Rupees Five Lacs. (There could be an upward revision of this amount from time to time).

The donor may be an individual or a trust or a group of individuals.

The Indian Mathematical Society will solely and independently own the amount donated to it.

A prospective donor should approach the General Secretary of the Indian Mathematical Society with a Offer. Keeping with the spirit of this Policy Guidelines and if so felt necessary, referring to the Council whether the proposal be negotiated or not, in his wisdom, the General Secretary will negotiate the terms and conditions for each donation proposal and will put it before the Council for its consideration and approval. The Council will deliberate on the proposal, and after modifications, if any, may accept the proposal through a special resolution with specific details mentioning the terms and conditions. This will be published in the IMS News Letter after the Donor agrees to the resolution of the Council.

Ordinarily during every Annual Conference of the Society there are several Invited Lectures and Symposia running in parallel sessions. One of these academic programmes may be permanently marked / identified as so and so sponsored programme in the (fond) memory of or so and so sponsored programme in the honor of as per the wish of each donor by the Council. This programme may be arranged in a parallel session during the Conference.

The Council through its Academic Planning Committee (APC) will be the final authority in this regard to finalize the name of a speaker of an invited talk or the names of the Symposia speakers for this sponsored programme. The modus operandi for identifying the speaker(s) may be decided by the Council.

The invited speaker(s) will be the guest of the host institution. In case of an honorarium, if any, to the invited speaker, the amount of the honorarium will not exceed the honorarium amount for the existing Memorial Award Lectures.

Ordinarily train travel to the extent of AC-2 Tier be reimbursed. However, in special cases the domestic air travel may be considered.

Not withstanding the above,

(A) An offer of a donation with a stipulated purpose (not as part of the corpus), may be accepted by the Council on its merit.

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Green initiative taken by the Society-
A fervent appeal to all members of the Society

As a part of the "Green Initiative "taken by the Society (for further details, refer Society's website www.indianmathsociety.org.in), the Council of the Society has decided to send online the soft copy of the Mathematics Student / give online access to the Mathematics Student to all the Life members instead of supplying the hard copy. For this purpose, all the members of the Society are requested to register their e-mail address online, along with Name and the **Unique Membership Number** therein, to J. R. Patadia on **imsgoesgreen@gmail.com** or **jamanadaspat@gmail.com** so that further necessary action can be taken.

Important Change:
This newsletter also includes the abstracts of accepted papers for presentation as well as abstracts of invited talks, etc. in the just ended annual conference. From this issue of the newsletter this policy will be followed every year and such abstracts shall not be included in the issues of **The Mathematics Student**.

Abstracts of the papers presented at the 84^{th} IMS Conference, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir

IMS MEMORIAL AWARD LECTURES

32^{st} P. L. BHATNAGAR MEMORIAL AWARD LECTURE

HYDRODYNAMIC INSTABILITIES IN POROUS MEDIA FLOWS by
Manoranjan Mishra, Department of Mathematics and Department of Chemical Engineering, Indian Institute of Technology Ropar, Rupnagar, Punjab, India.
Email: manoranjan@iitrpr.ac.in

The average global carbon dioxide (CO_2) content of the atmosphere has increased from 315 ppm in 1960 to 405 ppm currently (September 2018). Closely correlated to this CO_2 -concentration measurement, the average global temperature of the atmosphere at the surface of the Earth has varied on many time scales. A possible way to mitigate the effects is to store CO_2 in large porous reservoirs within the earth and hydrodynamic instability plays a key role in determining both the feasibility and risks involved in this geological sequestration. Similarly oil-recovery, chromatography separation, contaminant transport in aquifers are a few out of many other porous media flows seeking attention of the mankind. These displacement processes encounter various hydrodynamic instabilities viz., Safmman-Taylor instability, Rayleigh-Taylor instability, to name a few. At a depth of 800 metres, CO_2 attains super critical state and becomes less dense and less viscous than the ambient brine solution. The viscosity and density contrast of underlying fluids in these systems results in an interfacial instability called viscous fingering (VF) and density fingering respectively. The finger like deformation of the interface when a less viscous fluid displaces a more viscous one in porous medium is termed as VF. VF is detrimental to oil recovery and chromatographic separation, while it enhances mixing in CO_2 sequestration and contaminant transport. Thus, controlling such instabilities is of paramount interest and many theoretical, experimental and numerical studies have been focussed on it. Mathematically, the miscible displacement process is described by coupling the continuity and Darcy equations with a convection-diffusion equation for solute concentration that determines the viscosity. The stability analysis of such mixing processes has some challenges due to unsteady base-state which leads to the study of a non-autonomous dynamical system. A detailed investigation about various control strategies ranging from an optimum flow rate to the use of reactive fluids (with convection-reaction-diffusion system) will be presented using both linear stability analysis and robust direct numerical simulations of couple partial differential equations.

29^{th} HANSRAJ GUPTA MEMORIAL AWARD LECTURE

TRENDS IN BORDISM, COBORDISM THEORY AND FIXED POINT SET: A SURVEY by S.S. Khare

29^{th} V. RAMASWAMY AIYER MEMORIAL AWARD LECTURE

SYMMETRIC FUNCTIONS by
K. N. Raghavan The Institute of Mathematical Sciences CIT Campus, Taramani, Chennai, India. Email: knr@imsc.res.in,

Symmetric functions are interesting not just for their own sake. They occur naturally in many other areas of mathematics and science, e.g., as characters in representation theory, and in the study of cohomology rings of Grassmannians and

other homogeneous spaces. There are several natural bases for the space of symmetric functions, perhaps the most interesting of which is the one formed by the Schur polynomials. The product of two given Schur polynomials is again a symmetric function, and thus can be expressed as a linear combination of Schur polynomials. The coefficients that appear in such expressions are of representation theoretic and geometric significance, and they can be calculated by the Littlewood-Richardson rule. A major portion of the talk will be devoted to an expository tour of these aspects (hopefully in a way that will make sense to a general mathematical audience). Towards the end of the talk, we will discuss a certain refinement of the Littlewood-Richardson rule (joint work with Mrigendra Singh Kushwaha and Sankaran Viswanath).

29^{th} SRINIVASA RAMANUJAN MEMORIAL AWARD LECTURE

SOME PARTITION IDENTITIES ANALOGOUS TO RAMANUJAN'S "MOST BEAUTIFUL IDENTITY" by N. Deka Baruah Tezpur University, India. Email: nayan@tezu.ernet.in

Let $p(n)$ denote the number of partitions of a non-negative integer n, with the convention $p(0) = 1$. In 1919, S. Ramanujan proved his so called "most beautiful identity" $\sum_{n=0}^{\infty} p(5n+4)q^n = 5\frac{(q^5;q^5)_\infty^5}{(q;q)_\infty^6}$, which immediately implies one of his three famous partition congruences, namely, $p(5n+4) \equiv 0(\mod 5)$. Here, for any complex number a and $|q| < 1$, $(a;q)_\infty := \prod_{k=0}^{\infty}(1aq^k)$. In this talk, we will discuss some other recently discovered analogous identities. Specifically, we will discuss on exact generating functions and congruences for some partition functions that are related to mock theta functions.

Apart from this **Satish Bhatnagar Award Lecture** was delivered by Prof Amartya K Dutta, ISI Kolkata on Skype as Prof Dutta could not come personally. Skype talk was the first time experience at IMS meeting and was successful.

Abstract of the Plenary Talk

1. RESOLUTION OF SINGULARITIES AND LOCAL UNIFORMIZATION, by Steven D. Cutkosky University of Missouri, Columbia, Missouri, USA. Email: cutkoskys@missouri.edu

An algebraic variety X over an algebraically closed field k is a space which is locally defined by the vanishing of a set of polynomials. The nonsingular points of X are the points where the tangent space to X has the same dimension as X. A resolution of singularities of X is a proper algebraic transformation from a nonsingular variety X' to X which is an isomorphism over a dense open subset of X. Resolutions of singularities exist over fields of characteristic zero (such as the complex numbers) as shown by Hironaka, and resolutions exist for varieties of dimension less than or equal to 3 over fields of positive characteristic as shown by Abhyankar. We discuss ideas in the construction of resolution of singularities in characteristic zero and why the proof does not extend to positive characteristic. We also discuss the related problem of local uniformization, which is resolution at the center of a given valuation.

2. CALCULUS OF VARIATIONS AND APPLICATIONS, by M. Vanninathan, Department of Mathematics, IIT Bombay, Mumbai, India Email: vanninathan@math.iitb.ac.in

Calculus of Variations is an old well-known topic which has been evolving. Starting from its roots in Classical Mechanics, one direction of its expansion is closely

linked with progress in Ordinary Differential Equations (ODE) and Partial Differential Equations (PDE). Modern developments however have oriented the subject towards applications. Indeed, prime examples are Control and Optimization Processes, which are so universal that arise in various disciplines including Engineering, Biology among others. In this lecture, we plan to trace some of these developments and end with an application to Optimal Design Problems motivated by Material Science.

Abstracts of the Invited Talks

1. SUBSETS OF βN WHICH ARE NOT BOREL, by Dona Strauss Univ. of Leeds, England. Email: D.Strauss@hull.ac.uk (Joint work with N. Hindman)

Many subsets of βN which are simple to define algebraically are far from simple topologically. I shall present a proof that the following subsets of N are not Borel: The set of idempotents; the smallest ideal; any principal right ideal of N^* ; N^*+N^*.

2. MAXIMAL LEFT IDEALS IN BANACH ALGEBRAS, by H. Garth Dales University of Lancaster, England Email: g.dales@lancaster.as.uk

Let A be a Banach algebra, and let M be a maximal left ideal. It is easy to see that often M must be closed in A and that sometimes it can be dense, with codimension 1 IN A. It has been conjectured that these are the only two possibilities. This is true for many classes of Banach algebras, including all commutative ones. But we construct a counter-example: given n N, there is a Banach algebra with a dense maximal left ideal of codimension n. I do not know if there is an example where the maximal left ideal has infinite codimension.

3. EQUIENERGETIC GRAPHS, by H. S. Ramane Department of Mathematics, Karnatak University, Dharwad, India. Email: hsramane@yahoo.com

The energy of a graph G, denoted by $E(G)$ is defined as the sum of the absolute values of the eigen values of its adjacency matrix. Two graphs G_1 and G_2 are said to be equienergetic graphs if $E(G_1) = E(G_2)$. For obvious reason the co-spectral graphs are equienergetic. The nontrivial example of equienergetic graphs are the cycles on 3 and 4 vertices, whose energy is equal to 4 and they are non co-spectral. But they do not possess equal number of vertices. Finding non co-spectral equienergetic graphs with same number of vertices is interesting one. In this paper we outline the various results on equienergetic graphs. Further, we show construction of equienergetic graphs for given number of vertices.

4. CONTROLLING THE ATMOSPHERIC LEVEL OF CARBON DIOXIDE TO MITIGATE GLOBAL WARMING: A MODELING STUDY, by A. K. Misra Department of Mathematics, Institute of Science, Banaras Hindu University, India.
Email: akmisra@bhu.ac.in

Global warming is one of the most devastating environmental threats. The root cause of global warming is the enhancement in the atmospheric concentration of greenhouse gases. Carbon dioxide (CO_2) is the prime greenhouse gas, responsible for nearly 64of the Earth's atmosphere. The major sources of atmospheric carbon dioxide are fossil fuel burning and deforestation. The emission of CO_2 from these anthropogenic sources has increased with the expansion in human population. Thus, human population is a critical factor behind global carbon dioxide increase. Another crucial factor which significantly affects the dynamics of atmospheric CO_2 is forest biomass. The study of the interplay between human population, forest biomass and atmospheric CO_2 is crucial to understand the dynamics of carbon

dioxide . In view of this, I have proposed a mathematical model to study the effect of human population and forest biomass on the dynamics of atmospheric CO_2 . The analysis of the proposed model shows that if the deforestation rate goes beyond a critical value, the concentration of atmospheric CO_2 does not get stabilized. For the reduction and stabilization of concentration of atmospheric CO_2, reforestation is a useful tool. But reforestation efforts are usually applied on the basis of forest biomass data which is measured some time earlier. This time delay may affect the effectiveness of reforestation efforts. Thus, I have studied the effect of the time delay, involved in between the measurement of forest biomass and implementation of reforestation efforts, on the reduction and stabilization of the atmospheric concentration of CO_2 . Curbing the carbon dioxide emissions from the point sources using technological options is one of the useful strategies to reduce the anthropogenic carbon dioxide emissions. I have also proposed a nonlinear mathematical model to study the impact of technological options, for the reduction of CO_2 emissions from fossil fuel burning and industrial processes, on the control of atmospheric concentration of CO_2 . The strategies which optimally reduce atmospheric CO_2 levels while minimizing the cost associated with the implementation of technological options are identified using optimal control theory. Apart from reforestation and technological options, environmental education is also an avenue to control the emission of CO_2 in the atmosphere. In this view, I have proposed a mathematical model to comprehend the effect of environmental education on the control of atmospheric CO_2 .

5. NUMERICAL SEMIGROUPS AND AFFINE CURVES, by Indranath Sengupta, Discipline of Mathematics, IIT Gandhinagar, Palaj, Gandhinagar, India. Email: indranathsg@iitgn.ac.in.

Let $\mathbb{N}$ denote the set of nonnegative integers. A numerical semigroup Γ is a subset of $\mathbb{N}$ containing 0, closed under addition and generates $\mathbb{Z}$ as a group. It is well known that the set $\mathbb{N}\backslash\Gamma$ is finite and that the semigroup has a unique minimal system of generators $n_0 < n_1 < \cdots < n_p$. The greatest integer not in Γ is called the Frobenius number of Γ, denoted by $F(\Gamma)$. Computing $F(\Gamma)$ is a hard problem in general, known as the Coin Exchange Problem. The numerical semigroup Γ is symmetric if $F(\Gamma)$ is odd and $x \in \mathbb{Z}\backslash F(\Gamma)$ implies $F(\Gamma) - x \in \Gamma$. Let k denote a field and $\eta : k[x_0, x_1, \cdots, x_p] \leftarrow k[t]$ be the mapping defined by $\eta(x_i) = t^{n_i}$, $0 \leq i \leq p$. Let $\mathbf{p}(n_0, \cdots, n_p) = ker(\eta)$. The map η is a monomial parametrization and defines a curve $C = \{(t^{n_0}, \cdots, t^{n_p})t \in k\}$, known as a *monomial curve* in the affine space A^{p+1} . It is still not known in general, if, given $p \geq 4$, symmetry condition on Γ imposes a bound on $\mu(\mathbf{p}(n_0, \cdots, n_p))$. In an attempt to understand this question, we stumbled upon an interesting class of numerical semigroups, namely those defined by the string of integers $n_0 < n_1 < \cdots < n_p$ formed by concatenation of two arithmetic sequences. We get infinite families of numerical semigroups that are symmetric and $\mu(\mathbf{p}(n_0, \cdots, n_p))$ is bounded. Symmetric numerical semigroups give natural classes of Gorenstein monomial curves in A^{p+1} . On the other hand, we have cases when $\mu(\mathbf{p}(n_0, \cdots, n_p))$ is unbounded and this generalizes Bresinsky's construction in arbitrary embedding dimension.

6. BAKER'S CONJECTURE ON PERMUTABLE ENTIRE FUNCTION by K. S. Charak, Department of Mathematics,University of Jammu, Jammu, India.
Email: kscharak7@rediffmail.com

Let f be an entire function. We denote by f^n, the n^{th} iterate of f. The Fatou set $F(f)$ and the Julia set $J(f)$ of f are defined as $F(f) = \{z \in \mathbb{C}\colon \{f^n\}$ is normal in

a neighborhood of $z\}$ and $J(f) = \mathbb{C}\backslash F(f)$, respectively. It is known that two permutable rational functions f and g of degree at least two have identical Julia sets. The corresponding problem for nonlinear entire functions, first mentioned by I.N. Baker in 1984, is still open, now known as Baker's Conjecture. In my talk, I shall discuss the recent progress made on this conjecture.

Symposium-I
HARMONIC ANALYSIS AND RELATED AREAS

1. ℓ_1-BASES IN BANACH ALGEBRAS AND STRONG ARENS IRREGULARITY OF ALGEBRAS IN HARMONIC ANALYSIS, by Mahmoud Filali Univ. of Oulu, Finland. (Email: mahmoud.filali@oulu.fi)

A long standing problem in abstract harmonic analysis concerns the strong Arens irregularity (sAir, for short) of the Fourier algebra $A(G)$ of a locally compact group G. The groups for which $A(G)$ is known to be sAir are all amenable. So far this includes the abelian groups, the discrete amenable groups, the second countable amenable groups G such that $\overline{[G,G]}$ is not open in G, the groups of the form $\prod_{i=0}^{\infty} G_i$ where each G_i, $i \geq 1$ is a non-trivial metrizable compact group and G_0 is a second countable locally compact group, the groups of the form $G_0 \times G$, where G is a compact group whose local weight $\omega(G)$ has uncountable cofinality and G_0 is any locally compact group with $\omega(G) \leq \omega(G)$,and the compact group $SU(2)$. The groups for which $A(G)$ is known to be not sAir have been recentlyextracted by Losert. These include the discrete groups containing $\mathcal{F}_r$ (the freegroup with r generators, where $r \geq 2$ is finite), the compact group $SU(3)$, the locally compact group $SL(2,R)$. We are concerned here with the groups for which $A(G)$ is sAir. We introduce a new class of ℓ_1-bases in Banach algebras. These new ℓ_1 -bases enable us, among other results, to unify all the results on strong Arens irregularity proved for algebras in harmonic analysis (except one) in the past including (almost) all the cases mentioned above for the Fourier algebras. In addition, also show that $A(G)$ is sAir for compact connected groups with an infinite dual rank.

2. TOPOLOGY OF TWISTS, EXTREMISING TWIST PATHS AND MULTIPLE SOLUTIONS TO THE NONLINEAR SYSTEM IN VARIATION $\mathbf{L}[\mathbf{U},\mathbf{F}] = \nabla\mathbf{P}$ by Ali Taheri, Sussex University, UK.
Email: A.Taheri@sussex.ac.uk

In this talk I discuss questions on the existence and multiplicity of a class of geometrically motivated mappings with certain symmetries that serve as solutions to the nonlinear elliptic system in variation:

$$ELS[(u,P),\Omega] = \begin{cases} L[u,F] = \nabla P & \text{in } \Omega \\ \det \nabla u = 1 & \text{in } \Omega \\ u \equiv x, & \text{on } \partial\Omega \end{cases}$$

where $\mathbf{L} = \mathbf{L}[u,F]$ is the partial differential operator
$L[u,F] = [\nabla u]^t\{div[F_\zeta(x,u,\nabla u)] - F_u(x,u,\nabla u)\}$. Here $\Omega \subset \mathbb{R}^n$ is a smooth bounded domain, $F = F(x,u,\zeta)$ is a sufficiently regular Lagrangian $F_u = F_u(x,u,\zeta)$ and $F_\zeta = F_\zeta(x,u,)$ with F_u and F_ζ denoting the derivatives of F with respect to the second and third variables respectively while P is an a priori unknown hydrostatic pressure resulting from the incompressibility constraint $\det \nabla u = 1$. Among other things, by considering twist mappings u with an $SO(n)$-valued twist path, we prove the existence of multiple and topologically distinct solutions to **ELS** for

$n \geq 2$ even versus the only (non) twisting solution $u \equiv x$ for $n \geq 3$ odd. An extremality analysis for twist paths and those of Lie exponential types and a suitable formulation of a differential operator action on twists relating to **ELS** are the key ingredients in the proof. We discuss intimate links with the geodesic flow and its closed orbits on the Lie group $\mathbf{SO}(n)$.

3. MAXIMAL LEFT IDEALS IN BANACH ALGEBRAS by H. Garth Dales, University of Lancaster, England. Email: g.dales@lancaster.as.uk

Let A be a Banach algebra, and let M be a maximal left ideal. It is easy to see that often M must be closed in A and that sometimes it can be dense, with codimension 1 in A. It has been conjectured that these are the only two possibilities. This is true for many classes of Banach algebras, including all commutative ones. But we construct a counter-example: given $n \in \mathbb{N}$, there is a Banach algebra with a dense maximal left ideal of codimension n. I do not know if there is an example where the maximal left ideal has infinite codimension.

4. EXPANSIVE AUTOMORPHISMS ON LOCALLY COMPACT GROUPS by Riddhi Shah JNU, Delhi, India Email: riddhi.kausti@gmail.com

An automorphism T of a locally compact group G is said to be expansive if there exists a neighborhood of the identity in G which does not contain any non-trivial T-invariant subset. We study if the expansivity carries over to the quotients modulo closed invariant subgroups when they are normal or compact. We also study the properties of groups admitting expansive automorphisms. We show that expansivity and distality are two opposite phenomena for any automorphism of a non-discrete locally compact group.

Symposium-II
COMMUTATIVE ALGEBRA AND ALGEBRAIC GEOMETRY

1. LOCAL COHOMOLOGY OF REES ALGEBRAS AND VANISHING OF NORMAL HILBERT COEFFICIENTS by J. K. Verma, IIT Mumbai, India. Email: verma.jugal@gmail.com

Normal Hilbert polynomials were introduced by David Rees. Rees characterised pseudo-rational local rings in terms of the vanishing of the constant term of the Normal Hilbert coefficient of all m-primary ideals in dimension 2 Cohen-Macaulay local rings. As a consequence of this characterisation, he obtained a new proof of Lipman's theorem about product of complete ideals in 2-dimensional rational singularities.

Itoh and Huneke explored this theme further. Itoh proved that the third normal Hilbert coefficient of the maximal ideal m in R in a Gorenstein local ring vanishes if and only if the normal reduction number of m is at most 2. He conjectured in 1992 that this result is true for all m-primary ideals in Gorenstein local rings. We shall discuss a similar criterion for higher normal Hilbert coefficients.

2. RESOLUTIONS OF NUMERICAL SEMIGROUP RINGS by Hema Srinivasan, Department of Mathematics, University of Missouri, Columbia, USA. Email: SrinivasanH@missouri.edu

Let $\mathbb{N}$ denote the semigroup of natural numbers (including zero) under addition. Subsemigroups of $\mathbb{N}$ are called the numerical semigroups. Let $G =< C >$ be a numerical semigroup minimally generated by a subset $C = (c_1, \cdots, c_n)$ of $\mathbb{N}$. If k is a field, $S = k[t^a | a \in G]$ is called the semigroup ring associated to G. This semigroup ring S is isomorphic to $k[x_1, \cdots, x_n]/I_C = R/I_C$ where I_C is the kernel of the map $\phi : k[x_1, \cdots, x_n] \leftarrow S$ given by $\phi(x_i) = t^{c_i}$. We discuss the problem of

constructing the minimal resolution of S over R. We will explicitly construct the resolutions in some cases and derive formulas for numerical invariants of S such as Betti Numbers, Regularity and Hilbert Series from the resolution. In particular, when $< C >$ decomposes or equivalently is a gluing of two subsemigroups $< A >$ and $< B >$ we construct the resolution in terms of those of A and B. This is part of my joint work with Philippe Gimenez of Valladolid.

3. ALEXANDER DUALS, MULTIPERMUTOHEDRON IDEALS AND λ-PARKING FUNCTIONS by Chanchal Kumar, IISER, Mohali.
Email: chkum2611@gmail.com

Let $n \geq 1$ and $\mathfrak{S}_n$ be the set of all permutations of $[n] = \{1, 2, \cdots, n\}$. For $\mathbf{u} = (u_1, \cdots, u_n) \in \mathbb{N}^n$ such that $0 \leq u_1 < u_2 < ... < u_n$, the monomial ideal $I(\mathbf{u}) = x^{\sigma(u)} : \sigma \in \mathfrak{S}_n$ in the polynomial ring $R = k[x_1, \cdots, x_n]$ (over a field k) is called a *permutohedron ideal*, where $x^{\sigma(u)} = \prod_{j=1}^{n} x_j^{u_{\sigma(j)}}$. If $u_1 \leq u_2 \leq \cdots \leq u_n$, then the corresponding monomial ideal $I(\mathbf{u})$ is called a *multipermutohedron ideal*. For some integer $c \geq 1$, let $\mathbf{u_n} + \mathbf{c} - \mathbf{1} = (u_n + c - 1, \cdots, u_n + c - 1) \in \mathbb{N}^n$. We consider the Alexander dual $I(\mathbf{u})^{[\mathbf{u_n}+\mathbf{c}-\mathbf{1}]}$ of the multipermutoderon ideal $I(\mathbf{u})$ with respect to $\mathbf{u_n} + \mathbf{c} - \mathbf{1}$ and compute its multi-graded Betti numbers. Also, the standard monomials of $\frac{R}{I(\mathbf{u})^{[\mathbf{u_n}+\mathbf{c}-\mathbf{1}]}}$ are given in terms of λ-parking functions.

4. COMMUTATIVE ALGEBRA OF SPECIAL DIVISORS ON A GRAPH by M. Manjunath, IIT Bombay, India. Email: madhu@math.iitb.ac.in

In 2007, Baker and Norine discovered a graph theoretic analogue of divisor theory on a compact Riemann surface. This theory has found applications in both algebraic geometry and combinatorics. However, the interplay between special divisors on a graph and its combinatorial structure is still largely mysterious. We study this problem from a commutative algebraic perspective, in particular via Hilbert series methods.

SYMPOSIUM-III
THEORY AND NUMERICS OF EVOLUTION EQUATIONS

1. FRACTIONAL NAVIER-STOKES EQUATIONS WITH NONLOCAL CONDITION by Shurti Dubey, Department of Mathematics, IIT Madras, India. Email: sdubey@iitm.ac.in

The present work is concerned with the time fractional Navier-Stokes equations (NSEqs). The fractional time derivative is described in the Caputo sense. The considered IBVP for NSEqs consists nonlocal initial condition which arises more precisely for physical measurements than the classical initial condition. We establish the existence and uniqueness of the mild solution for the considered problem, making use of theory of fractional calculus, theory of semigroups of operators, fixed point theorem. We also prove the regularity result for the solution which leads us to the existence of classical solution.

2. DEVELOPMENT AND IMPLEMENTATION OF A NEW VORTICITY INTEGRAL CONDITION FOR NON-PRIMITIVE NAVIER-STOKES EQUATION by Shuvam Sen, Department of Mathematical Sciences, Tezpur University, India. Email: shuvam@tezu.ernet.in

A new integral vorticity boundary condition has been developed and implemented to compute solution of non-primitive NavierStokes equation. Global integral vorticity condition having original character can be considered to be of entirely different kind compared to other vorticity conditions available in literature. The procedure realized as explicit boundary conditions imitates the original integral equation. The

main purpose is to introduce an algorithm which is easy to implement and versatile. This algorithm based on the new vorticity integral condition captures accurate vorticity distribution on the boundary of computational flow field and can be used for both wall bounded flows as well as flows in open domain. The approach has been arrived at without utilizing grid points outside of the computational domain. Convergence analysis of this alternative vorticity integral condition in combination with semi-discrete centered difference approximation of linear Stokes equation has been carried out. Correct pressure field near the wall, for both attached and separated boundary layer flows, by using stream function and vorticity field variables are computed. The competency of the proposed boundary methodology vis-a-vis other popular vorticity boundary conditions has been amply appraised by its use in a model problem that embodies the essential features of the incompressibility and viscosity. Subsequently the proposed methodology has been further validated by computing analytical solution of steady Stokes equation. Finally, it has been applied to three benchmark problems governed by the incompressible Navier-Stokes equations, viz. lid driven cavity, backward facing step and flow past a circular cylinder. The results obtained are in excellent agreement with computational and experimental results available in literature, thereby establishing efficiency and accuracy of the proposed algorithm. Accurate prediction for both vorticity and pressure fields could be achieved.

3. SUITABLE DIFFUSION FOR CONSTRUCTING NON-OSCILLATORY ENTROPY STABLE SCHEMES by Ritesh Kumar Dubey, Research Institute, SRMIST, Chennai, India. Email: riteshkumar.d@res.srmuniv.ac.in

In this talk we review the theory of entropy stable schemes and explicitly characterize the amount of suitable diffusion required in entropy stable fluxes to construct non-oscillatory schemes in total variation diminishing (TVD) sense. Further, high resolution entropy stable TVD fluxes are constructed and a generic TVD-entropy stable region is given for the flux limiter functions. The non-oscillatory TVD property of proposed fluxes does not depend on the choice of entropy functions and different choices for diffusion matrices are proposed for these fluxes. These fluxes are extendable to the system of higher dimension and resulting entropy stable schemes are used to numerically compute the solution for Burgers and shallow water equations in 1D and 2D case. It is also shown numerically that, the use of proposed diffusion matrices in TECNO schemes can significantly suppress the oscillations exhibited by them with other diffusion matrices. Numerical results show that the resulting schemes capture steady shock exactly and produce non-oscillatory solution profile with high resolution.

Symposium-IV
CODING THEORY AND CRYPTOGRAPHY

1. ERROR-CORRECTING CODES AND STANLEY-REISNER IDEALS OF MATROIDS by Trygve Johnsen, University of Tromso, The Arctic University of Norway. Email: trygve.johnsen@uit.no

We will show how one can determine various code parameters of some linear error-correcting codes, by studying resolutions of Stanley-Reisner rings associated to the simplicial independence complexes of a series of matroids associated to each of the codes. The code parameters will include generalized Hamming weights and higher weight spectra, and we will apply these methods to some simple (projective) Reed-Mller codes.

2. THE MATHEMATICS OF DNA CODES by Manish Gupta, Dhirubhai

Ambani Institute of Tech, Gandhi Nagar, India. Email: mankg@daiict.ac.in

Computing and Communications are the two backbones for today's modern world of daily life. Coding theory (a well-developed branch of mathematics with roots in computer science and origin in electrical engineering) is at the heart of both. On the other hand, in the last two decades molecular biology has made significant progress due to the advancement in "omics" area. Biology is now digital generating a lot of data. In 1994 in a seminal paper, successful experiment for DNA computing was performed by Adleman. The heart of the DNA computing is the DNA hybridization, however, it is also the source of errors. Thus the success of the DNA computing depends on the error control techniques. The classical coding theory techniques have provided foundation for the current information and communication technology (ICT). Thus it is natural to expect that coding theory will be the foundational subject for the DNA computing paradigm. For the successful experiments with DNA computing usually we design DNA strings which are sufficiently dissimilar. This leads to the construction of a large set of DNA strings which satisfy certain combinatorial and thermodynamic constraints. Over the last 16 years, many approaches such as combinatorial, algebraic, computational have been used to construct such DNA strings. In this talk, we will focus our attention on constructing optimal DNA codes using algebraic rings and isometry. If time permits, we will also cover a beautiful area of DNA storage.

3. LINEAR RECURRING VECTOR SEQUENCES OVER FINITE FIELDS by Sartaj Ul Hasan, IIT Jammu, India. Email: sartajulhasan@gmail.com

Linear feedback shift registers are used as basic building blocks in most of the modern stream ciphers. These ciphers produce only a single bit per clock and hence are often referred to as bit- oriented ciphers. Bit-oriented ciphers not only have large period and good statistical properties, but also have low cost of implementation in hardware and thus are quite useful in applications like wireless communications. However, in many situations such as high speed link encryption, an efficient software encryption is required and bit-oriented ciphers do not provide adequate efficiency.

The question arises how to design feedback shift registers (FSRs) that output a word instead of a bit per clock. A very natural and obvious way is to consider FSRs over extension fields, but then field multiplication being an expensive operation would not really make our life easy in terms of software efficiency. Other way is to exploit word operations logic operations and arithmetic operations of modern computer processors in designing FSRs so as to enhance their efficiency in software implementation. In fact, Preneel (1995) poses a question if one can design fast and secure FSRs with the help of the word operations of modern processors and the techniques of parallelism.

Interestingly, a solution to Preneel's problem was already available in the literature even before it was formally stated and was given by Niederreiter (1993) in the form of his multiple-recursive matrix method for generating pseudorandom vectors. This method involves matrix multiplication which is again an expensive operation as far as software efficiency is concerned. Zeng et al. (2007) resolve this problem by imposing restriction on the choice of matrices used in multiple- recursive matrix method. It may be noted that Tsaban and Vishne (2002) also addressed the problem of Preneel by introducing the notion of transformation shift registers and it turns out that transformation shift register is a special case of multiple-recursive matrix method. We will discuss some results concerning the enumeration of irreducible transformation shift registers. We will also discuss some recent results about linear complexity of sequences generated by transformation shift registers.

4. GOOD INTEGERS AND THEIR APPLICATIONS TO CODING THEORY, by Madhu Raka, Panjab University, India. Email: mraka@pu.ac.in

Good integers introduced in 1997 form an interesting family of integers that has been continuously studied due to their rich number theoretical properties and wide applications. In this talk, we will give characterizations of Good integers and of 2 good integers, which are generalizations of good integers. We will discuss properties of such integers and their applications in characterizing and enumerating self-dual negacyclic codes over finite fields. An alternative proof for the characterization of the existence of a self-dual negacyclic code over finite fields has been given in terms of such generalized good integers. A general enumeration formula for the number of self-dual negacyclic codes of length n over finite fields has been established. For some specific lengths, explicit formulas have been provided as well.

Symposium-V
OPERATOR THEORY AND TOPOLOGY

1. OPERATOR SPACE AND OPERATOR SYSTEM TENSOR PRODUCTS by Ajay Kumar, University of Delhi, Delhi, India.
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Given a Hilbert space H and $n \in \mathbb{N}, M_n(B(H))$ is a C^*-algebra with order, norm and algebraic structure at each matrix level $M_n(B(H))$. An operator space V is a subspace of $B(H)$ together with the naturallyinherited norms on $M_n(V)$ through its inclusion $M_n(B(H))$, and an operator system a self-adjoint unital subspace with matrix ordering induced at each $M_n(V)$. After giving a brief introduction to the basics of these spaces, we discuss recently introduced theory of polynomial induced λ-tensor products that generalizes the projective, Haagerup and Schur tensor product in the category of operator spaces, and the maximal tensor product in the category of operator systems. Some further developments in this theory, related to the Banach *-algebra structure and behavior of inductive limits have also been included.

2. COMPACT MATRIX OPERATORS BETWEEN SEQUENCE SPACES by M. Mursaleen, Department of Mathematics, Aligarh Muslim University Aligarh, India. Email: mursaleenm@gmail.com

In this talk, we present a brief survey of theory and applications of measures of non- compactness. The classical measures of non-compactness are discussed and their properties are compared. The approaches for constructing measure of non-compactness in a general metric or linear space are described, along with the classical results for existence of fixed point for condensing operators. Also several generalization of classical results are mentioned and their applications in various problems of analysis such as linear equation, differential equations, integral equations and common solutions of equations are discussed. The most effective way in the characterization of compact operators between the Banach spaces is applying the Hausdorff measure of non-compactness. In this talk, we present some identities or estimates for the operator norms and the Hausdorff measures of non-compactness of certain operators given by infinite matrices that map an arbitrary BK-space into the sequence spaces c_0, c, ℓ_∞ and ℓ_1 . Many linear compact operators may be represented as matrix operators in sequence spaces or integral operators in function spaces. Recently the measures of non-compactness are applied in solving infinite system of differential equations and integral equations in sequence spaces.

3. REVISITING ENVELOPING SEMIGROUPS by Anima Nagar, IIT

Delhi. Email: anima@maths.iitd.ac.in

A flow is a pair (X, T) of compact metric space X and a topological group T acting on X, and topological dynamics is the study of the dynamics resulting from the action of T on X. Robert Ellis had defined and studied the algebraic properties of a flow (X, T) via the "Enveloping Semigroup". The Enveloping Semigroup $E(X)$ is defined as the closure of the set of homeomorphisms as an action of T on X in X^X with the product topology. In this talk we revisit the dynamical properties of Enveloping Semigroups of dynamical flows and look out for connections between these properties to some dynamical behavior of the flow.

4. LINEAR CANONICAL TRANSFORMS AND THEIR CONNECTION WITH HARDY TYPE OPERATORS, by Pankaj Jain, Department of Mathematics, South Asian University Akbar Bhawan, New Delhi, India.
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In this talk, we shall focus on Linear Canonical Transform (LCT). In connection with the LCT, we shall discuss the Schwartz type spaces $S_{\Delta,\alpha,A}, S^{\Delta,\beta,B}, S^{\Delta,\beta,B}_{\Delta,\alpha,A}$ and study the mapping properties of LCT between these spaces. Also, corresponding to LCT, we shall discuss sine transform, cosine transform and their connection with Hardy type operators. The situation in one as well as in two dimensions will be discussed.

Symposium-VI
SPECIAL FUNCTIONS AND TRANSFORMS METHODS

1. APPLICATIONS OF SPECIAL FUNCTIONS IN FUNCTION THEORY by A. Sairam Kaliraj, IIT Ropar, Rupnagar, Punjab, India.
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Many special functions encountered in mathematics, and applied sciences are special cases of Gaussian Hypergeometric functions. In this talk, we discuss about hypergeometric functions, its domain of analyticity, integral representation, functional equations and limiting behaviour. Then, we can have glimpse on sufficient conditions for harmonic functions to be in the geometric subclasses of univalent harmonic mappings. By making use of hypergeometric functions we construct several geometric subclasses of univalent harmonic mappings, and minimal surfaces.

2. A STUDY ON GEOMETRICAL SIGNIFICANCE OF FRACTIONAL CALCULUS by R. K. Jana, Department of Applied Mathematics and Humanities, S. V. National Institute of Technology, Surat, India.
Email: rkjana2003@yahoo.com

The geometrical significance of integer order derivative is known to us. To understand the geometrical significance of derivative of arbitrary order, we need to go through some basic formulas of fractional calculus. Here in this paper, an attempt is made to study geometrical interpretation of fractional calculus by considering polynomial function. Graphical representation, fractional divergence and critical point of polynomial function has been investigated.

3. ALMOST AUTOMORPHIC SOLUTIONS OF IMPULSIVE DIFFERENTIAL EQUATIONS by Syed Abbas, School of Basic Sciences, IIT Mandi, Mandi, INDIA. Email: abbas@iitmandi.ac.in

In this talk, we discuss the concept of almost automorphic solutions. Almost automorphic functions are immediate generalization of almost periodic functions. We discuss such solutions of differential equations with impulsive conditions. Some

examples will be given to illustrate the analytical findings.

IMS Prizes

IMS PRIZE-GROUP-1: DISCRETE MATHEMATICS, LATTICE THEORY, SET THEORY, LOGIC, NUMBER THEORY AND RELATED AREAS

NIL

IMS PRIZE-GROUP-2: ALGEBRIC GEOMETRY, GEOMETRY, TOPOLOGY, ALGEBRIC TOPOLOGY AND RELATED AREAS

1. VARIANTS OF EXPANSIVENESS IN NON-AUTONOMOUS DISCRETE SYSTEMS by Radhika Vasisht, Department of Mathematics, University of Delhi, Delhi, India. Email: radhika.vasisht92@gmail.com

In this paper, we define and study variants of expansiveness, namely n- expansiveness, $\aleph_0$-expansiveness and meagre expansiveness for non-autonomous discrete dynamical systems. We discuss various properties of such non-autonomous systems and give necessary examples. We prove results related to non-existence of $\aleph_0$-expansive and meagre expansive non-autonomous system on certain spaces. We also study relation between $\aleph_0$-expansive and meagre-expansive non-autonomous system.

IMS PRIZE-GROUP-3: MEASURE THEORY, PROBABILITY THEORY, STOCHASTIC PROCESS AND RELATED AREAS.

NIL

IMS PRIZE-GROUP-4: DIFFERENTIAL/ INTEGRAL/ FUNCTIONAL EQUATIONS AND INEQUALITIES, SPECIAL FUNCTIONS, NUMERICAL ANALYSIS AND RELATED AREAS

1. ACCURACY PRESERVING ENO AND WENO SCHEMES USING NOVEL SMOOTHNESS MEASUREMENT by Biswarup Biswas, SRM Research Institute & Department of Mathematics, SRM Institute of Science and Technology, India. Email: biswarupb7@gmail.com

A novel procedure is given for choosing smoothest stencil to construct less oscillatory ENO schemes. The procedure is further used to define smoothness parameter in the non-linear weights of new WENO schemes. The main significant features of these new ENO and WENO schemes is that they are less oscillatory and achieve their relevant order of accuracy in the presence of critical points in the exact solution. It is shown theoretically as well as computationally in L^1 and L^∞ norm. Moreover, computational results are given to show less oscillatory behavior of the new WENO scheme compared to WENO5-JS and WENO5-Z schemes.

2. A NEW EXTENSION OF THE BASIC BESSEL FUNCTION AND ITS PROPERTIES by Meera H. Chudasama, P. D. Patel Institute of Applied Sciences, Charotar University of Science and Technology, Gujarat, INDIA. Email: meera.chudasama@yahoo.co.in

We introduce a new basic Bessel function with an objective of making the series rapidly convergent and preserving the entire function nature. We derive the generating function relation, the contour integral representation, two inequalities and some summation formulas; most of them agree with the corresponding existing properties the basic Bessel function and its limiting case. However, the differential equation it satisfies turns out to be of infinite order. Interestingly, the sine, cosine and hence the exponential functions admit new basic analogues through this new

approach of study.

IMS PRIZE-GROUP-5: SOLID MECHANICS, FLUID MECHANICS, ELCTROMAGNETIC THEORY, MAGNETO-HYDRODYNAMICS, ASTRONOMY, ASTROPHYSICS AND RELATED AREAS.

NIL

IMS PRIZE-GROUP-6: OPERATIONS RESEARCH, OPTIMIZATION, COMPUTATIONAL MATHEMATICS, INFORMATION TECHNOLOGY, BIOMATHEMATICS, HISTORY OF MATHEMATICS AND RELATED AREAS

NIL.

AMU PRIZE ALGEBRA, DIFFERENTIAL GEOMETRY AND FUNCTIONAL ANALYSIS AND RELATED AREAS

NIL

V.M.SHAH PRIZE: REAL ANALYSIS, COMPLEX ANALYSIS, FOURIER ANALYSIS, HORMONIC ANALYSIS, APPROXIMATION THEORY AND RELATED AREAS

1. ON COMPOSITION OF TRANSCENDENTAL ENTIRE FUNCTIONS AND SPIDER'S WEB by Garima Tomar, Department of Mathematics, Central University of Haryana India. Email: tomar.garima10@gmail.com

If f and g are transcendental entire functions, we discuss the dynamics of various types of escaping sets of composition of transcendental entire functions $f \circ g$ and $g \circ f$ and also it's relations with regard to its factors f and g. Concept of spider's web was given by Rippon and Stallard. We find some results associated with the spider's web.

2. RESULTS ON UNIQUENESS OF PRODUCT OF CERTAIN TYPE OF DIFFERENCE POLYNOMIALS by Husna V., Department of Mathematics, Presidency University, Rajanukunte, Bangalore, Karnataka, India. Email: husnav43@gmail.com

In this paper, using the concept of weakly weighted sharingand relaxed weighted sharing, we investigate the uniqueness of product of certain type of difference polynomials. The results of the paper improve and extend some recent results due to Renukadevi S. Dyavanal and Ashwini M. Hattikal.

3. ON CLASS OF INTEGRAL FUNCTIONS REPRESENTED BY MULTIPLE DIRICHLET SERIES by Nibha Dua, Department Of Mathematics, Netaji Subhas University Of Technology, India. Email: nibhad.phd.16@nsit.net.in

In the present paper we make a characterization of the vector valued coefficients of multiple Dirichlet Series for when the series converges absolutely in the entire complex plane and prove some results on class of those series satisfying a certain condition.

4. UNIQUENESS AND VALUE SHARING OF MEROMORPHIC FUNCTIONS WITH REGARD TO MULTIPLICITY SHARING A SMALL FUNCTION by Rajeshwari S., Department of Mathematics, School of Engineering, Presidency University, Bangalore-India. Email: rajeshwari.s@presidencyuniversity.in

We study the uniqueness theorem of meromorphic functions that share one small

function. A uniqueness result which related to multiplicity of meromorphic function is proved in this paper.

5. RADII OF CONVEXITY AND STARLIKENESS OF CERTAIN FUNCTIONS WITH POSITIVE REAL PART by Sushil Kumar, Bharati Vidyapeeth's College of Engineering, Delhi, India. Email: sushilkumar16n@gmail.com

In this paper, we determine the radius of convexity of the starlike functions associated with cardioid. Further, the radius results associated with the Bell numbers for the various well-known subclasses of starlike functions with positive real part are computed. The results obtained are sharp.

IMS PAPER PRESENTATIONS

SECTION A: COMBINATORICS, GRAPH THEORY AND DISCRETE MATHEMATICS

1. BOUNDS FOR THE EIGEN VALUES AND ENERGY OF DEGREE PRODUCT ADJACENCY MATRIX OF A GRAPH by Keerthi G. Mirajkar, Bhagyashri R. Doddamani, Department of Mathematics, Karnatak University's Karnatak Arts College, Dharwad, Karnataka, India.
Email: keerthi.mirajkar@gmail.com, bhagyadoddamani1@gmail.com

In this article, we obtain a bound for eigen values of degree product adjacency matrix $[DPA(G)]$ and also obtain some lower bounds for the degree product adjacency energy of graph G.

2. THE LINE MYCIELSKIAN GRAPH OF A GRAPH by Keerthi G. Mirajkar[1] and Veena N. Mathad[2] [1]Department of Mathematics, Karnatak University's Karnatak Arts College, Dharwad, Karnataka, India. [2]Department of Mathematics, University of Mysore, Manasagangotri, Mysore, Karnataka, India.Email: keerthi.mirajkar@gmail.com

In this paper, we introduce the concept of the mycielskian graph of a graph. We obtain some properties of this graph. Further we characterize those graphs whose line mycielskian graph and mycielskian graph are isomorphic. Also, we establish characterization for line mycielskian graphs to be Eulerian and Hamiltonian.

3. LEAP ZAGREB INDICES OF TENSOR PRODUCT OF GRAPHS by Keerthi G. Mirajkar, Anuradha V. Deshpande and Bhagyashri R. Doddamani, Department of Mathematics, Karnatak University's Karnatak Arts College, Karnataka, India. Email: anudesh08@gmail.com

The present research paper deals with the study of leap Zagreb indices of tensor product of cycles.

4. THREE-WAY COMBINATORIAL INTERPRETATIONS OF ROGERS-RAMANUJAN IDENTITIES by S. Sharma and M. Rana, School of Mathematics, Thapar Institute of Engineering and Technology, Punjab, INDIA. Email: sharma_stary2k@yahoo.co.in, mrana@thapar.edu

Combinatorial interpretations of the Rogers-Ramanujan identities Subject Class are provided in terms of n-color partitions and generalized Frobenius partitions. These results lead to the interpretations of two fifth order mock theta functions by attaching weights.

5. $(N+T)$-COLOR OVERPARTITIONS AND GENERALIZED Q-SERIES by V. Gupta and M. Rana, School of Mathematics, Thapar Institute of Engineering and Technology, Punjab, INDIA. Email: vasudha@thapar.edu, mrana@thapar.edu

In this paper we use the $(n+t)$-color overpartitions for providing the combinatorial interpretations of some generalized q-series. All our proofs are combinatorial. For some particular cases, we discuss Rogers-Ramanujan type identities from Slater's compendium and Chu and Zhang's compendium.

6. SQUARE SUM LABELING OF BOW, BISTAR, SUBDIVISION GRAPHS by N. Arunvigneshwari and R. Uma, Department of Mathematics, Sree Saraswathi Thyagaraja College of Arts Science, Coimbatore, Tamilnadu, India. Email: arun55math@gmail.com, ramumaraj@gmail.com

We found new functions for Bow graph, Bistar graph and Subdivision graph. We are extending our research for CUBE SUM LABELLING through Square Sum Labeling.

7. CONSTRUCTION OF NEAR BENT FUNCTIONS AND ITS CRYPTOGRAPHIC PROPERTIES by Prasanna Poojarya, Vadiraja Bhatta G. R. and P.K. Harikrishnan, Department of Mathematics, Manipal institute of Technology, Manipal Academy of Higher Education, Manipal, Karnataka, India. Email: vadiraja.bhatta@manipal.edu

Bent functions, semi bent functions and near bent functions are Boolean functions which are useful in cryptography. In this paper near bent functions are constructed using Kasami function exponent and Gold function exponent in trace form. Cryptographic properties such as nonlinearity, balancedness, zero correlation immunity and algebraic immunity are illustrated.

8. A NOTE ON INDEPENDENT DOMINATION NUMBER OF PRODUCT OF EULER TOTIENT CAYLEY GRAPH AND ARITHMETIC GRAPH by Madhukar M. Pawar and Shilpa T. Bhangale

In this paper we provided some counter examples which disprove the result on independent domination number of product of Euler Totient Cayley Graph and Arithmetic Graph proved by B. Maheswari and S.Uma Maheswari and et al. and tried to improve it up to some extent.

9. THE ATOM BASED GRAPH OF AN ADJUNCT OF TWO LATTICES by U. R. Borsarkar, Department of Mathematics, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, India. Email: uttarasanjay@gmail.com

In this paper we prove some properties of the atom based graph of an adjunct of two lattices. Also the realizability of horn graphs and some special graphs as the atom based graph of a lattice is shown.

10. THE ESSENTIAL ELEMENT GRAPH OF A BOOLEAN LATTICE by Vidya Deshmukh, Department of Mathematics, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, India. Email: vidyade24@gmail.com

Let L be a lattice. The essential element graph of L, denoted by E_L, is a graph whose vertex set is the set of all nonzero proper elements of L and two vertices a and b are adjacent whenever $a \vee b$ is an essential element. In this paper we study the essential element graph of a lattice and we investigate its properties. Also, we investigate the essential element graph of a Boolean lattice 2^n.

11. THE MINIMUM VV-COLORING LAPLACIAN ENERGY OF A GRAPH by Sayinath Udupa, R. S. Bhat and Vinay Madhusudanan, Department of Mathematics, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, Karnataka, India. Email: sayinath.udupa@manipal.edu

Let $B(G)$ denote the set of all blocks of a graph G. Two vertices are vv-adjacent

if they incident on the same block. Then vv-degree of a vertex $u, d_{vv}(u)$ is the number vertices vv-adjacent to the vertex u. In this paper we introduce new kind of graph energy, the minimum vv-coloring Laplacian energy of a graph denoting it as $LE_{cvv}(G)$. It depends both on underlying graph of G and its particular colors on its vertices of G. Upper and lower bounds for $LE_{cvv}(G)$ are established.

12. BINOMIAL INCIDENCE MATRIX OF A SEMIGRAPH by Sudhakara. G, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, Karnataka, India. Email: sughakara.g@manipal.edu

The concept Semigraph was introduced by E. Sampathkumar, which is a generalization of graph, in which number of vertices on edges is more than or equal to two. The idea of multiple vertices on edges may gives rise to multiplicity in every concept of graph when generalized to semigraph. In this paper we deal with representation of a semigraph by an incidence matrix such that the matrix represents the semigraph uniquely and we study structural properties of semigraph in terms of matrix parameters.

13. COMPLEXITY OF ALGORITHMS AND COMPUTER PROGRAMS FOR A NEW APPROACH TO FIND HIGHEST COMMON FACTOR AND LEAST COMMON MULTIPLE by R. K. Budhraja, Department of Mathematics, Sri Venkateswara College, University of Delhi, Delhi, India. Email: rkbudhraja@yahoo.com

A different approach to find HCF and LCM for a list of numbers is introduced. The approach is a step by step procedure in the form of an algorithm, thereby resulting in first ever Computer Program to find HCF and LCM for a given list of numbers. Computer programs are formed and executed successfully in C^{++} language. Complexity of these algorithms is studied and determined.

SECTION B: ALGEBRA, NUMBER THEORY AND LATTICE THEORY

1. ON SKEW LIE PRODUCT AND DERIVATIONS OF PRIME RINGS WITH INVOLUTION by Adnan Abbasi and Muzibur Rahman Mozumder, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email: adnan.abbasi001@gmail.com, muzibamu81@gmail.com

Let R be a ring with involution. The skew Lie product of $a, b \in R$ is defined by $*[a, b] = ab - ba^*$. The purpose of this paper is to study some identities involving derivation on skew Lie product in prime rings with involution.

2. LEFT-M-FILTER, RIGHT-N-FILTER AND $(M; N)$-FILTER IN ORDERED SEMIGROUP by Ahsan Mahboob, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email: khanahsan56@gmail.com

In this paper, as a generalization of the concepts of left filters, right filters and filters of ordered semigroups, the concepts, for any positive integers m and n, of left-m-filters, right-n-filters and (m, n)-filters in ordered semigroups have been introduced and some properties of these generalized notions have been investigated. Finally left-m-filters (resp. right-n-filters, (m, n)-filters) of $(m, 0)$-regular (resp. $(0, n)$-regular, (m, n)-regular) ordered semigroups have been characterized in terms of its prime generalized $(m, 0)$-ideals (resp. $(0, n)$-ideals, (m, n)-ideals.

3. MULTIPLICATIVE $*$-LIE TRIPLE HIGHER DERIVATIONS ON STANDARD OPERATOR ALGEBRAS by Bilal Ahmad Wani, Department of Mathematics, Aligarh Muslim University, Aligarh, India.
Email: bilalwanikmr@gmail.com

We divide our analysis into the study of operators on general Banach spaces, and later we turn our attention to Hilbert space operators. Let X be a Banach space of dimension $n > 1$ and $\mathfrak{U} \subset \mathfrak{B}(\mathfrak{X})$ be a standard operator algebra. In this paper it is shown that if a mapping $d : A \to A$ (not necessarily linear) satisfies $d([[U, V, W]) = [[d(U, V, W] + [[U, d(V), W] + [[U, V, d(W)])$ for all $U, V, W \in A$ then $d = \psi + \tau$, where ψ is an additive derivation of A and $\tau : A \to FI$ vanishes at second commutator $[U, V, W]$ for all $U, V, W \in A$. Moreover, if d is linear and satisfies the above relation, then there exists an operator $S \in A$ and a linear mapping τ from A into FI satisfying $\tau([[U, V, W]) = 0$ for all $U, V, W \in A$, such that $d(U) = SUUS + \tau(U)$ for all $U \in A$. Further, this result is extended to the multiplicative Lie triple higher derivations on A. Finally it is shown that if A is a standard operator algebra on an infinite dimensional complex Hilbert space H containing identity operator I which is closed under the adjoint operation then every multiplicative $*$-Lie triple derivation $d : AB(H)$ is a linear $*$-derivation. Moreover, if there exists an operator $S \in B(H)$ such that$S + S^* = 0$ then $d(U) = SUUS$ for all $U \in A$, that is, d is inner. Further, it is also shown that any multiplicative $*$-Lie triple higher derivation $D = \{\delta_n\}_{n\in\mathbb{N}}$ of A is automatically a linear inner higher derivation on A with $d(U)^* = d(U)$.

4. DERIVATIONS VANISHING ON COMMUTATOR IDENTITY INVOLVING GENERALIZED DERIVATION ON MULTILINEAR POLYNOMIALS IN PRIME RINGS by Sajad Ahmad Pary, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email: paryamu@gmail.com

In the present article, we investigate the action Generalized derivation F, on the multilinear polynomials in prime rings.

5. NEW CONGRUENCES MODULO 2, 4, AND 8 FOR THE NUMBER OF TAGGED PARTS OVER THE PARTITIONS WITH DESIGNATED SUMMANDS by Nayandeep Deka Baruah and Mandeep Kaur, Department of Mathematical Sciences, Tezpur University, Napaam, Assam. Email: kaur.man0974@gmail.com

Recently, Lin introduced two new partition functions $PD_t(n)$ and $PDO_t(n)$, which count the total number of tagged parts over all partitions of n with designated summands and the total number of tagged parts over all partitions of n with designated summands in which all parts are odd. Lin also proved some congruences modulo 3 and 9 for $PD_t(n)$ and $PDO_t(n)$, and conjectured some congruences modulo 8. Very recently, Adansie, Chern, and Xia found two new infinite families of congruences modulo 9 for $PD_t(n)$. In this paper, we prove the congruences modulo 8 conjectured by Lin and also find many new congruences and infinite families of congruences modulo some small powers of 2.

6. COMBINATORIAL PROPERTIES OF SPARSELY TOTIENT NUMBERS by Mithun Kumar Das, Pramod Eyyunni and Bhuwanesh Rao Patil, Harish Chandra Research Institute Allahabad, Allahabad. Email: pramodeyy@gmail.com

Let $N_1(m) = max\{n : \phi(n) \leq m\}$ and $N_1 = \{N_1(m) : m \in \phi(\mathbb{N})\}$ where $\phi(n)$ denotes the Euler's totient function. Masser and Shiu called the elements of N1 as 'sparsely totient numbers'. In this talk, based on our paper Combinatorial properties of sparsely totient numbers", we will see some results on sparsely totient numbers. Firstly, we discuss certain divisibility properties of these numbers. Next, we construct explicit infinite families of elements in N1. We will also try to look at additive and multiplicative patterns in N1.

7. MODULAR CONVEX SUBLATTICES OF A LATTICE by R. M.

Hafizur Rahman, Department of Mathematics, Faculty of Science, Begum Rokeya Univ., Rangpur, Bangladesh. Email: salim030659@yahoo.com

This paper introduces the notion of modular convex sublattices. Several characterizations of modular convex sublattices is given here. Moreover, it is proved that for a modular convex sublattice S and an ideal I of a lattice, if $I \wedge S = (a]$ and $I \vee S = (b]$ then I is a principal ideal, provided $I \cap S = \emptyset$.

8. FUZZY SEMI-ORTHOGONALITY IN FUZZY LATTICES by M. Wasadikar and Payal Khubchandani, Dr. Vithal Rao Vikhe Patil College of Engineering, Ahmed Nagar, Maharashtra. Email: payal_khubchandani@yahoo.com

We consider the notion of fuzzy lattices introduced by chon and define fuzzy semi-ortholattice and fuzzy semi-orthocomplemented lattice. Moreover we define covering and exchange property in fuzzy lattices and prove some relationships.

9. GEOMETRIC PROGRESSIONS IN SYNDETIC SETS by Bhuwanesh Rao Patil, Harish-Chandra Research Institute, Allahabad, India
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In order to investigate multiplicative structures in additively large sets, Beiglbck et al. raised a significant open question as to whether or not every subset of the natural numbers with bounded gaps (syndetic set) contains arbitrarily long geometric progressions. A result of Erdfs implies that syndetic sets contain a 2-term geometric progression with integer common ratio, but we still do not know if they contain such a progression with common ratio being perfect square. Here we prove that for each $k \in \mathbb{N}$, a syndetic set contains 2-term geometric progressions with common ratios of the form $n^k r_1$ and $p^k r_2$, where $p \in \mathbb{P}$(the set of primes), $n \in \mathbb{N} \backslash \mathbb{P}$, $r_1 \equiv 1(mod n), r_2 \equiv 1(mod p)$ and $r_1, r_2 \in \mathbb{N}$. We also show that syndetic sets with bounded gap two contain infinitely many 2-term geometric progressions with their respective common ratios being perfect squares.

10. CHARACTERIZATION OF DELETABLE ELEMENTS, REDUCIBILITY AND REDUCIBILITY NUMBERS IN VARIOUS COMPLEMENTED LATTICES by Vilas Kharat, Department of Mathematics, Savitribai Phule Pune University, Pune. Email: laddoo1@yahoo.com

In this paper we have obtained the characterizations of deletable elements and reducibility in section complemented, semicomplemented, section semicomplemented, uniquely complemented, relatively uniquely complemented and relatively complemented lattices. The notion of reducibility number is introduced by Kharat, Waphare, Thakare. We have studied reducibility number in these complemented lattices.

11. 0-DISTRIBUTIVE NEARLATTICE by A. S. A. Noor[1], Md. Zaidur Rahman[2] and Dilruba Nusrat[3], [1]Department of ETE, Prime University, Dhaka, Bangladesh, [2]Department of Mathematics, Khulna University of Engineering & Technology, Khulna, Bangladesh, [3]Department of CSE, Prime University, Dhaka, Bangladesh. Email: asanoor100@gmail.com

J. C. Varlet gave the notion of 0-distributive lattices to generalize the concept of pseudo complemented lattices. In this paper, the authors extended the concept for near-lattices. They include several characterizations of these near-lattices. They also provide a separation theorem in a 0-distributive near-lattice S for annihilator ideals of finite subsets of S. Some characterizations of weakly complemented near-lattices are given by using a special congruence. Finally they prove that a 0-distributive near-lattice which is both sectionally and weakly complemented is a semi Boolean near-lattice.

12. SEMI PRIME FILTERS OF A JOIN SEMILATTICE by Md. Ayub Ali, Department of Mathematics, Jagannath University, Dhaka, Bangladesh, A. S. A. Noor, Department of E C E Mathematics, Prime University, Dhaka, Bangladesh, Muhammad Asaduzzaman Akanda, Department of Mathematics, Alhaj Mockbul Hossain University, Dhaka, Bangladesh and Md. Mamunur Rashid, Department of Mathematics, Adarsho Karigori and Banijjik College, Rajshahi, Bangladesh. Email: ayub_ju@yahoo.com

The concept of semi prime filters was given by Y. Rav by generalizing the notion of 1-distributive lattices. A filter of a lattice is called a semi prime filter if for all $x, y, z \in L$, $x \vee y \in F$ and imply $x \vee z \in F$ and $x \vee (y \wedge z) \in F$. In this paper, we extend the concept for directed below join semi lattices. A join semi lattice is called directed below if for all $a, b \in S$ there exists $c \in S$ such that $c \leq a, b$. Here we include several characterizations of semi prime filters in directed below join semi lattices. We prove that a filter F in S is semi prime if and only if its every maximal ideal disjoint from F is prime. We provide a result related to prime separation theorem. At the end we include a result on minimal prime filters in S.

13. GENERATING FUNCTIONS AND CONGRUENCES FOR GENERALIZED FROBENIUS PARTITIONS WITH 9 COLOURS by Nayandeep Deka Baruah and Nilufar Mana Begum, Department of Mathematical Sciences, Tezpur University, Sonitpur, Assam, India. Email: nilufar@tezu.ernet.in, nayan@tezu.ernet.in

Recently, Chan, Wang and Yang used the theory of modular forms to find representations of the generating function for $c\phi_9(n)$, which denotes the number of generalized Frobenius partitions with 9 colors. They also proved the congruences $c\phi_9(3n+1) \equiv 0(\mod 34)$, $c\phi_9(3n+2) \equiv 0(\mod 36)$, $c\phi_9(9n+3) \equiv 0(\mod 32)$, and $c\phi_9(9n+6) \equiv 0(\mod 32)$. In this paper, we write the relevant generating functions in such a way that the congruences become trivial. We also deduce the new congruences $c\phi_9(27n+15) \equiv 0(\mod 34)$ and $c\phi_9(27n+24) \equiv 0(\mod 34)$.

14. FUZZY WEAKLY IRREDUCIBLE IDEALS OF A RING by Jyoti Khubchandani. Email: khubchandani_jyoti@yahoo.com

In this paper, we introduce the concept of a fuzzy weakly irreducible ideal of a commutative ring R with identity. This concept is a generalisation of a fuzzy strongly irreducible ideal. Also relationships between fuzzy maximal, fuzzy quasi primary and fuzzy weakly irreducible ideals in a ring are proved.

15. ON TWO SUPERCONGRUENCE CONJECTURES OF BING HE FOR TRUNCATED HYPERGEOMETRIC SERIES by Arjun Singh Chetry and Gautam Kalita, Indian Institute of Information Technology Guwahati. Email: achetry52@gmail.com

Using some formulas of hypergeometric series and properties of Gamma function, we here give proof of two supercongrunce conjectures of Bing He for truncated hypergeometric series.

16. AUTOCOMMUTING PROBABILITY OF A FINITE GROUP by Parama Dutta and Rajat Kanti Nath, Department of Mathematical Sciences, Tezpur University, Napaam, Assam, India. Email: parama@gonitsora.com, rajatkantinath@yahoo.com

Let G be a finite group and $Aut(G)$ the automorphism group of G. The autocommuting probability of G, denoted by $Pr(G, Aut(G))$, is the probability that a randomly chosen automorphism of G fixes a randomly chosen element of G. In this

paper, we study $Pr(G, Aut(G))$ through a generalization. We obtain a computing formula, several bounds and characterizations of G through $Pr(G, Aut(G))$. We conclude the paper by showing that the generalized autocommuting probability of G remains unchanged under autoisoclinism.

17. SEMI-COMPLEMENT GRAPH OF LATTICE MODULES by Sachin Ballal, Department of Mathematics, Savitribai Phule Pune University, Pune. Email: ballalshyam@gmail.com

Let L be a C-lattice and M be a lattice module over L. In this paper, we introduce the semi-complement graph of M denoted by $\Gamma(M)$, is the undirected graph with all semi-complement elements of M as a vertex set, and two vertices X and Y are adjacent if and only if $X \vee Y$ is a semi-complement element. We investigate some properties of $\Gamma(M)$ under some conditions on M. For instance, we characterize non connected graph $\Gamma(M)$of a principally generated comultiplication lattice module M over a C-lattice L.

18. CHARACTERIZATION OF DELETABLE ELEMENTS IN POSETS by Machchhindra Gophane and Vilas Kharat, Department of Mathematics, Shivaji University, Kolhapur, India. Email: mtg_maths@unishivaji.ac.in

Reducibility in poset was introduced by Kharat and Waphare. The aim this paper is to study a notion of reducibility in some classes of finite posets. It is known that the class of distributive posets and Modular posets are not reducible. So, we characterize the deletable elements in a Modular and Distributive Posets. Also, we characterize the deletable elements in semidistributive and semimodular Posets.

19. MINIMAL AND COMPLETELY PRIME IDEALS OF (σ, δ) - RINGS AND THEIR EXTENSIONS by Meeru Abrol, Government P. G. College for Women, Gandhi Nagar, Jammu, India. Email: meeru.abrol@yahoo.in

Let R be a Noetherian, integral domain which is also an algebra over $\mathbb{Q}$($\mathbb{Q}$ is the field of rational numbers). Let σ be an automorphism of R and δ a σ-derivation of R. A ring R is called a (σ, δ)- ring if $a(\sigma(a) + \delta(a)) \in P(R)$, where $P(R)$ is the prime radical of R implies that $a \in P(R)$ for $a \in R$. We prove that R is 2-primal if prime radical of R is δ-invariant. We also study the property of minimal prime ideals of R and prove the following in this direction: Let R be a Noetherian, integral domain which is also an algebra over . Let σ be an automorphism of R and δ a σ-derivation of R such that R is a (σ, δ)- ring. If minimal prime ideal P of R is σ-stable, then it is δ-invariant. Further if prime radical of R is δ-invariant, then skew polynomial ring of P is a completely prime ideal of skew polynomial ring of R.

20. EDGES IN ZERO DIVISOR GRAPH OF MATRIX RINGS by V.K. Bhat and Pradeep Singh, School of Mathematics, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir, India. Email: pradeep333singh@gmail.com, vijay.bhat@smvdu.ac.in

The idea of a graph associated to zero divisors of a commutative ring was first introduced by Beck in (1988), where he was mainly interested in colorings. This definition of zero divisor graph is then extended to non-commutative rings by Redmond in (2002). In this paper, we deduce a relation to find the number of zero divisors in matrix ring $M_2(\mathbb{Z}_p)$. Further, we use this relation to determine the number of edges of zero divisor graph of $M_2(\mathbb{Z}_p)$.

21. PROPERTIES OF SYMMETRICAL DIFFERENCE OVER INTUITIONISTIC FUZZY MATRICES by S.Sriram, Mathematics Wing, Directorate of Distance Education, Annamalai University, Annamalainagar, India

and J. Boobalan, Department of Mathematics, Manbumigu Dr. Puratchithalaivar M.G.R. Government Arts and Science College, Kattumannarkoil, India. Email: jboobalan@hotmail.com, ssm 3096@yahoo.co.in

In this paper, we define symmetrical difference of intuitionistic fuzzy matrices and study some of its algebraic properties.

22. MULTIPLICATIVE LIE TRIPLE HIGHER DERIVATIONS ON GENERALIZED MATRIX ALGEBRAS by Mohd Shuaib Akhtar, Department of Mathematics, Aligarh Muslim University, Aligarh, India.
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Let $\mathbb{N}$ be the set of nonnegative integers and $G = (A, M, N, B)$ be a 2-torsion free generalized matrix algebra over a commutative ring R. In the present paper, under some lenient assumptions on G, it is shown that if $\Delta\{\delta n\}_{n\in\mathbb{N}}$ is a sequence of mappings $\delta_n : G \to$ (not necessarily linear) satisfying $\delta_n([[a, b], c]) = \sum_{r+s+t=n}[[\delta_r(a), \delta_s(b)], \delta_t(c)]$ for all $a, b, c \in G$, then for each $n \in \mathbb{N}$, $\delta_n = d_n + \tau_n$; where $d_n : G \to G$ is an additive mapping satisfying $d_n(ab) = \sum_{r+s=n} d_r(a)d_s(b)$ for all $a, b \in G$ i.e., $D = \{d_n\}_{n\in\mathbb{N}}$ is an additive higher derivation on G and $tau_n : G \to Z(G)$ where $Z(G)$ is the center of G is a map vanishing at every second commutator $[[a, b], c]$.

23. NONEXISTENCE OF CERTAIN TYPES OF ROTATIONAL SYMMETRIC PLATEAUED BOOLEAN FUNCTIONS by Shashi Kant Pandey, Department of Computer Application, Maharaja Surajmal Institute, GGSIP University, New Delhi, India. Email: shashikantshvet@gmail.com

Plateaued Boolean functions satisfy optimum non-linearity. They exist in both balanced and unbalanced forms. Trade off among cryptographic properties play important role in the selection of good Boolean function. Therefore it is essential to know the existence of Boolean function for some fixed parameters. It reduces the huge search space of all possible Boolean function from $\mathbb{F}_2^n$ to $\mathbb{F}_2$. There are some results on the non existence of certain type of plateaued Boolean function in n variable by Hyun et al.. In this paper we formulate the necessary condition for rotational symmetric plateaued Boolean function and using them enumerate some new cases for the non existence of r-plateaued unbalanced rotational symmetric Boolean functions for $n = 2q$, q is any odd prime and $0 \le r \le n$. Partially we present another viewpoint for the problem on r-plateaued balanced rotational symmetric Boolean function for $n = 11$ proposed by Maximov et al.

24. GRADED COMPONENTS OF LOCAL COHOMOLOGY MODULES II by Tony J. Puthenpurakal and Sudeshna Roy, Department of Mathematics, Indian Institute of Technology Bombay, Mumbai, India. Email: sudeshnaroy.11@gmail.com, tputhen@math.iitb.ac.in

Let A be a commutative Noetherian ring containing a field K of characteristic zero and let $R = A[X_1, \cdots, X_m]$. Consider R as standard graded with $\deg a = 0$ for all $a \in A$ and $\deg X_i = 1$ for all i. We present a few results about the behavior of the graded components of local cohomology modules H^i_I (R) where I is an arbitrary homogeneous ideal in R. We mostly restrict our attention to the Vanishing, Tameness and Rigidity problems.

25. EAKIN-SATHAYE TYPE THEOREMS FOR JOINT REDUCTIONS OF IDEALS by Kriti Goel, Sudeshna Roy and Jugal Verma, IIT Bombay. Email: kriti@math.iitb.ac.in, kritigoel.maths@gmail.com

Paul Eakin and Avinash Sathaye, in 1976, proved the following result. Let I be an

ideal of a local ring R with infinite residue field. If $\mu(I^n) < \binom{n+r}{r}$ for some positive integers n and r, then there is a reduction J of I generated by r elements such that $JI^{n-1} = I^n$. In this paper, analogues of Eakin-Sathaye theorem for reductions of ideals are proved for -graded good filtrations. These analogues yield bounds on joint reduction vectors for a family of ideals. Examples related to lex-segment ideals in polynomial rings and contracted ideals in 2-dimensional regular local rings are constructed to show the effectiveness of these bounds.

26. HERZOG-KUHL EQUATIONS AND ITS APPLICATIONS by Rajiv Kumar, Department of Mathematics, IIT Madras. Email: gargrajiv00@gmail.com

In 1984, Herzog and Khl give relations of Betti numbers and their shifts for pure Cohen-Macaulay modules over polynomial rings over a field k. We generalize their result for pure modules of finite projective dimension over standard graded k-algebras. We give the following applications for the Herzog-Khl equations; we characterize the property of ring to be Cohen-Macaulay in terms of modules with pure resolutions. Secondly, we discuss the extremal rays of Betti Cones. This is a joint work with H. Ananthnarayn.

27. AN ALGEBRAIC CHARACTERIZATION OF THE AFFINE THREE SPACE by Nikhilesh Dasgupta and Neena Gupta, Statistics and Mathematics Unit, Indian Statistical Institute, Kolkata, India. Email: its.nikhilesh@gmail.com, rnanina@gmail.com

In this paper we give algebraic characterizations of the affine 2-space and the affine 3-space over an algebraically closed field of characteristic zero, using a variant of the Makar-Limanov invariant.

28. ON RESIDUAL AND STABLE COORDINATES by Amartya Kumar Duttal, Statistics and Mathematics Unit, Indian Statistical Institute, Kolkata and Animesh Lahiriy, Swami Vivekananda Research Centre, Ramakrishna Mission Vidyamandira, Howrah. Email: amartya.28@gmail.com, 255alahiri@gmail.com

In a recent paper, M. E. Kahoui and M. Ouali have proved that over an algebraically closed field k of characteristic zero, residual coordinates in $k[X][Z_1, \cdots, Z_n]$ are one-stable coordinates. In this paper we extend their result to the case of an algebraically closed field k of arbitrary characteristic. In fact, we show that the result holds when $k[X]$ is replaced by any one-dimensional seminormal domain R which is affine over an algebraically closed field k. For our proof, we extend a result of S. Maubach giving a criterion for a polynomial of the form $a(X)W+P(X, Z_1, \cdots, Z_n)$ to be a coordinate in $k[X][Z_1, \cdots Z_n, W]$. Kahoui and Ouali had also shown that over a Noetherian d-dimensional ring R containing $\mathbb{Q}$ any residual coordinate in $R[Z_1, \cdots, Z_n]$ is an r-stable coordinate, where $r = (2^d - 1)n$. We will give a sharper bound for r when R is affine over an algebraically closed field of characteristic zero.

SECTION C: REAL AND COMPLEX ANALYSIS (INCLUDING SPECIAL FUNCTONS, SUMMABILITY AND TRANSFORMS)

1. ON THE GROWTH OF MEROMORPHIC SOLUTIONS OF HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS WITH ENTIRE COEFFCIENTS OF $[P, Q]-\phi$ ORDER by Sanjib Kumar Datta1,Nityagopal Biswas, Department of Mathematics, University of Kalyani, West Bengal and Samten Tamang, Department of Mathematics, University of Burdwan, West Bengal. Email: sanjibdatta05@gmail.com, stamang@math.buruniv.ac.in, nityamaths@gmail.com

In the paper, we investigate the growth of transcendental meromorphic solutions

of complex higher order linear differential equations in which the coefficients are entire functions of $[p;q]-\phi$rder, p and q being positive integers with $p \leq q$ and $\phi : [0,\infty) \to (0,\infty)$ be a non-decreasing unbounded function. A class of new results extending some earlier results has been proved in this paper.

2. A VALUE DISTRIBUTION RESULT RELATED TO HAYMAN'S ALTERNATIVE by Kuldeep Singh Charak and Anil Singh, Department of Mathematics, University of Jammu, Jammu, India. Email: anilmanhasfeb90@gmail.com

Motivated by Bloch's Principle, we prove a value distribution result for meromorphic functions which is related to Hayman's alternative in certain sense.

3. A FURTHER EXTENSION OF GENERALIZED HURWITZ LERCH ZETA FUNCTION OF TWO VARIABLES by Saniya Batra and Prakriti Rai, Department of Mathematics, Amity University, Noida, U.P., India. Email:saniyabatra09@gmail.com, prai@amity.edu

In this paper we introduce an extension of generalized HurwitzLerch Zeta Function (defined by Pathan and Daman) and then systematically investigate its several properties and various integral representations which provide certain known as well new extensions of earlier stated results.

4. ROUGH I-STATISTICAL CONVERGENCE OF SEQUENCES by Prasanta Malik, Argha Ghosh, Department of Mathematics, University of Burdwan, Golapbag, Burdwan, West Bengal and Manojit Maity, Teachers Housing Estate, P.O. Panchasayar, Kolkata, India.Email: pmjupm@yahoo.co.in., buagbu@yahoo.co.in, manojitm@research.jdvu.ac.in

The concept of rough convergence of sequences was first introduced by H. X. Phu in his paper "Rough convergence in normed linear spaces, Numer. Funct. Anal. And Optimiz. 22 (2001), 199-222". Gradually a lot of work had been done on this concept and a new version of statistical convergence had come through the work of S. Aytar in his paper "The rough statistical convergence, Numer. Funct. Anal and Optimiz., 29(3) (2008), 291-303". Through further progress of this concept, I-statisticalconvergence was then introduced by U. Yamanc and M. Grdal in their paper "I-statistical convergence in 2-normed spaces, Arab. J. of Math. 20(1) (2014), 41-47". The concept of rough ideal statistical convergence of a sequence was first defined by Das, Savas and Ghosal in their paper "On generalization of certain summability methods using ideals, Appl. Math. Let. 24 (2011), 1509-1514". Here in this paper using the concept of Das et.al. we prove some results on rough ideal statistical convergence and also we introduce the notion of rough ideal limit set and discuss some topological aspects on this set.

5. CONNECTION PROBLEMS AND MATRIX REPRESENTATIONS FOR CERTAIN HYBRID POLYNOMIALS by Subuhi Khan and Tabinda Nahid, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email:tabindanahid@gmail.com

In this paper, we deal with the connection and duplication problems associated with the hybrid Sheffer family. The hybrid Sheffer polynomials are also studied via matrix approach. The properties of these polynomials are established using simple matrix operations. Examples providing the corresponding results for certain members of the hybrid Sheffer family are considered. This article is first attempt in the direction of obtaining connection and duplication coeffcients and matrix representations for the hybrid polynomials.

6. SOME TRANSFORMS OF THE ${}_PR_Q(\alpha,\beta;Z)$ **FUNCTION** by Rachana

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The aim of this paper is to discuss some transforms of the ${}_pR_q$ function, which is the generalization of Mittag-Leffler function, hypergeometric function, Wright functions and many other special functions. Various integral transforms such as Laplace Transform, Euler Transform etc. of the pRq functions are derived in this paper.

7. ON THE ESTIMATION OF DEFICIENCY OF ENTIRE FUNCTION by Sanjib Kumar Datta and Sukalyan Sarkar, Department of Mathematics, University of Kalyani, West Bengal. Email: sanjibdatta05@gmail.com, sukalyanmath.knc@gmail.com

The prime target of this paper is to determine and estimate some bounds regarding different kinds of deficiencies of entire functions. Some examples are also provided to justify the results.

8. WEAKLY KTHE-ORLICZ SEQUENCE SPACES by Kuldip Raj and Anu Choudhary, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir, India. Email:kuldipraj68@gmail.com, anuchoudhary407@gmail.com

In this article, we introduce and study some vector-valued Kthe-Orlicz sequence spaces over n-normed spaces. We make an effort to study some inclusion relations, algebraic and topological properties of these sequence spaces.

9. STARLIKE FUNCTIONS ASSOCIATED WITH EXPONENTIAL FUNCTION AND THE LEMNISCATE OF BERNOULLI by Kanika Khatter, Department of Applied Mathematics, Delhi Technological University, Delhi, India. Email:kanika.khatter@yahoo.com

Let f be the function defined on the open unit disk, with $f(0) = 0 = f'(0) - 1$, satisfying the subordinations $\frac{zf'(z)}{f(z)} < \alpha(1-\alpha)e^z$ or $\frac{zf'(z)}{f(z)} < \alpha(1-\alpha)\sqrt{1+z}$ respectively, where $0 \leq \alpha < 1$. The sharp radii has been determined for these functions to belong to several well-known classes. In addition, some inclusion relations and coefficient estimates have also been obtained. Joint paper with Dr. V. Ravichandran and Dr. S. Sivaprasad Kumar.

10. ON SOME NEW DIFFERENCE SEQUENCE SPACES DERIVED BY USING RIESZ MEAN AND A MUSIELAK-ORLICZ FUNCTION by Kuldip Raj and Renu Anand. School of Mathematics, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir, India. Email: kuldipraj68@gmail.com, renuanand71@gmail.com

In this paper we introduce new difference sequence spaces $r^q(M, \Delta_n^m, u, p)$ by using Riesz mean and Musielak-Orlicz function. We also make an effort to study some topological properties and compute $\alpha-, \beta-$ and $\gamma-$ duals of these spaces. Finally, we study matrix transformations on newly formed spaces.

11. LEMNISCATE CONVEXITY AND LEMNISCATE CARATHEODORY OF SOME ANALYTIC FUNCTIONS by Vibha Madaan, Department of Mathematics, University of Delhi, Delhi, India. Email: vibhamadaan47@gmail.com

Sufficient conditions on associated parameters p, b and c are obtained so that the generalized and normalized Bessel function. $u_p(z)$ satisfies $|\big(\frac{(1+zu_p''(z)}{u_p'(z)}\big)^2 - 1| < 1$ and $|\big(\frac{(zu_p(z))'}{u_p(z)}\big)^2 - 1| < 1$. We also determine the condition on the parameters

so that $\left(4\frac{(p+\frac{(b+1)}{2})}{c}\right)u_p'(z)\sqrt{1+z}$. Relations between the parameters μ and p are obtained such that the normalization $h_{\mu,p}(z)$ of the Lommel function of first kind satisfies the subordination $1+\frac{zh_{\mu,p}''(z)}{h_{\mu,p}'(z)}\sqrt{1+z}$. Moreover, the properties of Alexander transform of the function $h_{\mu,p}(z)$ are discussed.

12. RADII PROBLEMS FOR NORMALIZED BESSEL FUNCTIONS OF FIRST KIND by Nisha Bohra and V. Ravichandran, Department of Mathematics, University of Delhi, Delhi, India.
Email: nishib89@gmail.com, vravi@maths.du.ac.in, vravi68@gmail.com.

For three different normalizations of Bessel function of first kind, the radius of k-parabolic starlikeness and k-uniform convexity of order are determined. The radius of strongly starlikeness and other related radius are also obtained for these functions. We also find optimal parameters for which these functions are k-parabolic starlike and k-uniformly convex in the open unit disk.

13. A STUDY ON GEOMETRICAL SIGNIFICANCE OF FRACTIONAL CALCULUS by T. Mandal, R. Roy and R. K. Jana, Department of Applied Mathematics & Humanities, S. V. National Institute of Technology, Surat, India. Email:timilan.svnit@gmail.com, 2011rroy@gmail.com, rkjana2003@yahoo.com

The geometrical significance of integer order derivative is known to us. To understand the geometrical significance of derivative of arbitrary order, we need to go through some basic formulas of fractional calculus. Here in this paper, an attempt is made to study geometrical interpretation of fractional calculus by considering polynomial function. Graphical representation, fractional divergence and critical point of polynomial function has been investigated.

14. A NOTE ON RELATIVE (P,Q,T) L-TH GROWTH FACTORS OF ENTIRE FUNCTIONS by Sanjib Kumar Datta and Banani Dutta, Department of Mathematics, University of Kalyani, West Bengal. Email: sanjibdatta05@gmail.com, duttabananimath@gmail.com

Many authors have investigated about different growth factors of entire functions. In this paper we investigate about some results on sum and product of different relative growth factors of an entire function with respect to another entire function in connection with a special type of non-decreasing unbounded function ψ.

15. ORDER BOUNDED WEIGHTED DIFFERENTIATION COMPOSITION OPERATORS ACTING BETWEEN DIRICHLET TYPE SPACES by Manisha Devi, Kuldip Raj and Ajay Kumar Sharma, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir, India.
Email: manisha192devi@gmail.com, kuldeep.raj@smvdu.ac.in

Gao et al. (2016) and Sharma (2017) investigated the order bounded weighted composition operator mapping into Dirichlet spaces. In this paper we extend their work and study the order boundedness of weighted differentiation composition operators acting between Dirichlet type spaces.

16. CERTAIN DISCRETE BESSEL AND TRICOMI CONVOLUTIONS by Shakeel Ahmad Naikoo, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email:shakeelnaikoo21@gmail.com

In this work, the discrete Bessel and Tricomi convolutions of the Laguerre-Gould-Hopper polynomials are introduced. Some important properties including recurrence relations and operational representations of these families are established.

For suitable values of indices and variables, the Laguerre-Gould-Hopper polynomials yield several special polynomials. Consequently results for the discrete Bessel and Tricomi convolutions of the corresponding special polynomials are also obtained.

17. LIE ALGEBRA $\mathcal{G}(0;1)$ AND 2-DIMENSIONAL HERMITE POLYNOMIALS by Mahvish Ali, Department of Applied Sciences and Humanities, Jamia Millia Islamia, New Delhi, India. Email: mahvishali37@gmail.com

The theory of group representations and its relation to special functions provide a powerful tool to the development of mathematical physics. Special functions appear as basis vectors and matrix elements corresponding to local multiplier representations of Lie groups. In this work, the problem of framing the 1-parameter 2D-Hermite polynomials $(1P2DHP)Z^{(\beta)}_{m,n}(z_1, z_2)$ (which are 2D orthogonal polynomials), into the context of the irreducible representations $\uparrow_{\omega,\mu}$ and $\downarrow_{\omega,\mu}$ of the four-dimensional Lie algebra $\mathcal{G}(0;1)$ is considered. This approach stresses the mathematical relevance of 2D-orthogonal polynomials and Lie algebras. Certain relations involving the $(1P2DHP)Z^{(\beta)}_{m,n}(z_1, z_2)$ are obtained using the approach adopted by Miller. The linear differential operators serve as useful tools towards obtaining these relations. The analysis has been carried out by generalizing the formalism relevant to $(1P2DHP)Z^{(\beta)}_{m,n}(z_1, z_2)$. Certain examples involving 2D-Hermite polynomials $H_{m,n}(z_1, z_2)$ and Laguerre polynomials $L^{(\alpha)}_n(z)$ are obtained as special cases.

18. SHEARLET AND UNCERTAINTY MINIMIZERS by Ashok Kumar Singh, Department of Applied Sciences and General Engineering, Army Institute of Technology, Dighi, Pune, Maharashtra, India. Email:ashok10368@gmail.com

The wavelets and the wavelet transforms are important concepts in pure and applied mathematics. On similar lines shearlets were studied. Directionality properties of shearlets are used in applications. In this paper we describe a method by which a shearlet is obtained. This study considers the shearlet group and its representation. An uncertainty principle is applied to define minimizers. The minimizers satisfy the shearlet admissibility condition. The shearlets obtained are the analogs of the Gaussians as they are obtained from application of an uncertainty principle. The method is simple and it can genarate a large class of shearlets.

19. TENSOR PRODUCTS OF BANACH QUASI $*$-ALGEBRAS AND THE PROBLEM OF CONTINUITY FOR REPRESENTABLE FUNCTIONALS by Maria Stella Adamo, University of Catania, Italy.
Email: msadamo@unict.it

In this poster we will present the construction of tensor products of Banach quasi $*$-algebras and discuss how representable functionals of the tensor product are related to those of the factors and vice-versa. As a consequence, we will discuss how $*$-semisimplicity and full representability pass from the tensor product to the factors and vice-versa. With the help of these results, we will discuss the problem of automatic continuity for representable functionals and explore some examples. This is a joint work with M. Fragoulopoulou (National and Kapodistrian University of Athens - Greece).

SECTION D: FUNCTIONAL ANALYSIS

1. ASYMPTOTICALLY REGULAR MAPPINGS AND COMMON FIXED POINT by Akash singhal, Department of Mathematics, Pratap Institute of Technology and Science, Sikar (Raj.), Rajesh kumar Sharma, Department of Mathematics, Govt. Holkar Science College, Indore (M.P.), Anil Agrawal, Faculty

of Science & Environment MGCGV, Chitrakoot, Satna (M.P.). Email: akashsinghal78@gmail.com, anil.agrawal2000@yahoo.co.in, raj_rma@yahoo.co.in

In this paper we give some common fixed point theorems in complete 2-metric space for compatible mappings using the idea of relative asymptotical regularity. Our result inspired by some earlier result of Nesic, Singh and Sharma and other exist results in literature. We will also gave an example that shows the applicability and validity of our result.

2. A CLASS OF INTEGRAL OPERATORS FROM WEIGHTED INTEGRAL TRANSFORMS TO DIRICHLET SPACES by Elina Subhadarsini and Ajay K. Sharma, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir, India. Email:elinamaths@gmail.com

In this paper, we consider a class of integral operators from weighted integral transforms to Dirichlet spaces. We characterized the boundedness and compactness of these operators from weighted integral transforms to Dirichlet spaces. Also we compute the exact norm of integral operators acting between these spaces.

3. A CONNECTION BETWEEN INFINITE MATRIX AND SEMINORM TO ORIGINATE ORLICZ VECTOR VALUED SEQUENCE SPACES AND THEIR STATISTICAL CONVERGENCE by Charu Sharma and Kuldip Raj, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir, India. Email: charu145.cs@gmail.com

In the present paper we introduce and study some vector valued sequence spaces by using infinite matrix, seminorm and a sequence of Orlicz functions with real n-normed space as base space. We make an effort to study some topological and algebraic properties of these spaces. We also show that these spaces are complete paranormed spaces when the base space is n-Banach space and investigate some inclusion relations between the spaces. Finally, we study statistical convergence of these spaces.

4. A STUDY OF ORLICZ-QUASI-CAUCHY DOUBLE SEQUENCES USING RH REGULAR MATRIX by Seema Jamwal, University Institute of Engineering and Technology, University of Jammu, Jammu, India. Email:seemajamwal8@gmail.com

In this research paper we pioneer, a new double sequence called Orlicz-Quasi-Cauchy double sequence, $(M, A, \Delta)_{OQC}$. We investigate continuity type properties of Orlicz double function defined on a double subset $A \times A$ of R^2 into R and study some vital results related to uniform continuity. In the last we also make an attempt to prove some topological properties of $(M, A, \Delta)_{OQC}$.

5. COMMON SOLUTION TO A GENERALIZED EQUILIBRIUM PROBLEM AND A FIXED POINT PROBLEM FOR A BREGMAN RELATIVELY NONEXPANSIVE MAPPING IN REFLEXIVE BANACH SPACE by Saleem Yousuf, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email:saleemamu12@gmail.com

In this paper, we introduce and study an iterative method for solving a generalized equilibrium problem and a fixed point problem for a Bregman relatively nonexpansive mapping in reflexive Banach space. We prove that the sequences generated by iterative algorithm converge strongly to a common solution of these problems in a reflexive Banach space under some suitable conditions. We also give the application to zero point problems for maximal monotone operator is given by the main result. Finally, at end of paper we give a numerical example to demonstrate our

main result.

6. INTUITIONISTIC FUZZY ZWEIER I-CONVERGENT DOUBLE SEQUENCE SPACES DEFINED BY MODULUS FUNCTION by Hira Fatima, Department Of Mathematics, Aligarh Muslim University, Aligarh, India. Email:hirafatima2014@gmail.com

Fuzzy set theory is a powerful hand set for modeling uncertainty and vagueness in various problems arising in field of science and engineering. It has a wide applications in various fields: population dynamics, chaos control, computer programming, nonlinear dynamical system, etc. In this article we introduce the intuitionistic fuzzy Zweier I-convergent double sequence spaces ${}_2Z^I_{(\mu,v)}(f)$ and ${}_2Z^I_{0(\mu,v)}(f)$ defined by modulus function and study the fuzzy topology on the said spaces.

7. MEASURES OF NONCOMPACTNESS IN $\overline{N}^Q_\Delta$ DIFFERENCE SEQUENCE SPACES by Ishfaq Ahmad Malik, Department of Mathematics, National Institute of Technology, Hazratbal, Srinagar, India.
Email: ishfaq_2phd15@nitsri.net

In this paper I first introduce $\overline{N}^q_\Delta$ summable difference sequence spaces and prove some properties of these spaces. I then obtain the necessary and sufficient conditions for infinite matrices A to map these sequence spaces into the spaces c, c_0 and $\ell_1\infty$. Finally, the Hausdorff measure of noncompactness is then used to obtain the necessary and sufficient conditions for the compactness of the linear operators defined on these spaces.

8. PRODUCT OF COMPOSITION AND DIFFERENTIATION OPERATORS ON A SPACE OF ENTIRE FUNCTIONS by Pawan Kumar, Department of Mathematics, Govt. Degree College Kathua, India and Mohd Arief, Department of Mathematics, Central University of Jammu, India. Email: pawan811@yahoo.in, ariefcuj15@gmail.com

The product of composition operator C_ϕ and differentiation operator $C_\phi D$ is written as $C_\phi D$ and DC_ϕ which are defined as $C_\phi Df = f \circ \phi$ and $DC_\phi f = (f \circ \phi)'$ respectively. In this paper, we characterize the continuity of the operators $C_\phi D$ and DC_ϕ on, the space of entire functions.

9. INTUITIONISTIC FUZZY I-CONVERGENT SEQUENCE SPACES DEFINED BY BOUNDED LINEAR OPERATOR by Mobeen Ahmad, Department of Mathematics, Aligarh Muslim University, Aligarh, India.
Email:mobeenahmad88@gmail.com

A Fuzzy theory was introduced by Zadeh, a huge number of research papers have been appeared on fuzzy theory and its applications as well as fuzzy analogues of the classical theories. Fuzzy set theory is a powerful hand set for modelling uncertainty and vagueness in various problems arising in field of science and engineering. Motivated by his work we introduce some certain Intuitionistic fuzzy I-convergent sequence spaces $S^I_{(\mu,v)}(B)$ and $S^I_{0(\mu,v)}(B)$ defined by bounded linear operator. The purpose of this paper is to construct the basic concepts of the so-called Intuitionistic fuzzy I- convergent sequence spaces. We study the fuzzy topology and algebraic properties of these spaces. In the last we also make an attempt to prove some inclusion relations involving these spaces.

SECTION E: DIFFERENTIAL EQUATIONS, INTEGRAL EQUATIONS AND FUNCTIONAL EQUATIONS

1. EXISTENCE AND EXPONENTIAL STABILITY FOR IMPULSIVE

STOCHASTIC PARTIAL FUNCTIONAL DIFFERENTIAL EQUATIONS WITH POISSON JUMPS by S. Poornima and A. Anguraj, Department of Mathematics, PSG College of Arts & Science, Coimbatore.
Email: poornivnp@gmail.com, angurajpsg@yahoo.com

In the present paper, we consider the impulsive stochastic partial functional differential equations with Poisson jumps and we prove the existence and uniqueness of the equation by using fixed point theorem and the resolvent operator. We also study the exponential stability of the system.

2. EXISTENCE RESULT FOR BOUNDARY VALUE PROBLEM OF HYBRID FRACTIONAL INTEGRO-DIFFERENTIAL EQUATIONS WITH NONLOCAL CONDITION by V. Oviya and M. Latha Maheswari, PSG College of Arts & Science, Coimbatore. Email: oviyavisu@gmail.com, lathamahespsg@gmail.com

We build up the fractional hybrid integro-differential equation including the caputo fractional derivative of order $1 < \alpha \leq 2$. We demonstrate the existence of solutions for boundary value problem of hybrid fractioal integro-differential equations with nonlocal condition.

3. A DISCUSSION OVER FEW MATHEMATICAL TOOLS IN CIVIL ENGINEERING by Lambodara Sahu, College of Military Engineering, Pune. Email: lsahucme@gmail.com

Infrastructure development which is a symbol of healthy economy and bring nation proud in the international forum is quite handicapped without involvement of civil engineering. At the same time Mathematics plays a vital role in civil engineering at various stages of construction of an infrastructure. The role geometry (plane and solid) in architectural drawing and structural design is commendable to bring the structure in to reality within estimated cost and time provides all amenities as desired. In civil engineering, application of many other branches of mathematics such as trigonometry, differential equation, matrices and determinants, Numerical method and Fourier Analysis, Fourier transform etc may be identified and discussed in this paper.

4. GENERALIZED HERMITE-BASED APOSTOL-BERNOULLI POLYNOMIALS AND THEIR PROPERTIES by Aparna Chaturvedi and Prakriti Rai, Department of Mathematics, Amity Institute of Applied Sciences, Amity University, Noida, India. Email: chaturvedi.aparna.tirwa@gmail.com, prakritirai.rai@gmail.com

We have generalized Apostol-Hermite-Bernoulli polynomials, Apostol-Hermite-Euler polynomials and Apostol-Hermite-Genocchi polynomials. These results extend some known summations and identities of Apostol-Hermite- Bernoulli polynomials, Apostol-Hermite-Euler polynomials and Apostol-Hermite-Genocchi polynomials.

We have also extended the generalized Apostol-Bernoulli polynomials and the generalized Apostol-Euler polynomials. The main results provide interesting extensions of a representation for the generalized Apostol-Bernoulli polynomials and the generalized Apostol-Euler polynomials, using extended Generalized Gauss hypergeometric functions and derived its applications.

In this paper, we have established more properties of generalized Apostol-Hermite-Bernoulli polynomials with three parameters and degree p. We shall show that there is an intimate connection between these polynomials and obtain some identities by applying the generating functions.

5. MATHEMATICAL STUDY OF WELL POSEDNESS OF FRACTIONAL-ORDER NEURAL NETWORK MODEL WITH PROPORTIONAL DELAY by Swati Tyagi and S.C. Martha, Department of Mathematics, Indian Institute of Technology Ropar, Punjab, India.

In this work, a fractional-order neural network with proportional time delay is examined towards its existence of unique solution. Sufficient conditions for the existence of solution of the given model are derived with respect to various initial conditions using analysis of fixed point theory and fractional calculus. The analytical findings are explained through numerical examples. These models are suitable when a process takes place through strongly anomalous media.

SECTION F: GEOMETRY

1. KAEHLERIAN SPACES ADMITTING IN H- PROJECTIVE VECTOR FIELD WITH CONSTANT SCALAR CURVATURE by U.S. Negi, H.N.B. Garhwal University, S.R.T. Campus Badshahi-Thaul, Tehri Garhwal, U.K. India. Email:usnegi7@gmail.com

Ishihara (1959) has studied holomorphically projective changes and their groups in an almost complex manifold and also proved on holomorphic planes. Obata (1965) has defined and studied Riemannian manifolds admitting a solution of a certain system of differential equations. In this paper, we have defined and studied Kaehlerian spaces admitting in H-projective vector field with constant scalar curvature and several theorems have been proved. Also, then find necessary and sufficient conditions for such a Kaehlerian space to be isometric to a complex projective space with Fubini-Study metric.

2. ON THE FLAG CURVATURE OF A HOMOGENEOUS FINSLER SPACE WITH AN INVARIANT (α, β)-METRIC by Kirandeep Kaur and Gauree Shanker Department of Mathematics and Statistics, Central University of Punjab, Bathinda, Punjab, India. Email:kirandeep.kaur@cup.ac.in

In this paper, first we derive an explicit formula for the flag curvature of a homogeneous Finsler space with an invariant infinite series (α, β)-metric. Next, we deduce it for naturally reductive homogeneous Finsler space with the above mentioned metric.

3. ON THE RIGIDITY OF SPHERICALLY SYMMETRIC FINSLER METRICS WITH ISOTROPIC E-CURVATURE by Gauree Shanker and Sarita Rani, Department of Mathematics and Statistics, School of Basic and Applied Sciences, Central University of Punjab, Bathinda, Punjab, India. Email: sarita.rani@cup.ac.in, saritas.ss92@gmail.com

In the current paper, first we establish the formula for mean Berwald curvature of a spherically symmetric Finsler metric. Further, we establish differential equations characterizing projectively as well as dually flat spherically symmetric Finsler metrics. Finally, we obtain a rigidity result on spherically symmetric Finsler metrics with isotropic E-Curvature.

SECTION G: TOPOLOGY

1. FIXED POINT RESULTS FOR GERAGHTY-WEAK CONTRACTIONS IN ORDERED PARTIAL RECTANGULAR B-METRIC SPACES by Mohammad Imdad and Mohammad Asim, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email: mhimdad@gmail.com, mailtoasim27@gmail.com, satishmathematics@yahoo.co.in

In this paper, we prove ordered-theoretic fixed point results for Geraghty-weak contraction in partial rectangular b-metric space. Our results extend and improve many existing results in literature and some new results. We also give an example which exhibits the utility of our results.

2. SEQUENCE SPACES OVER N-NORMED SPACES DEFINED BY A MUSIELAK-ORLICZ FUNCTION OF ORDER (α, β) by Sunil K. Sharma, Department of Mathematics, Cluster University of Jammu, Jammu, J& K, India. Email: sunilksharma42@gmail.com

In the present paper we introduce sequence spaces over n-normed spaces defined by a Musielak-Orlicz function $M = (M_k)$ of order (α, β). We examine some topological properties and prove some inclusion relations between the resulting sequence spaces.

3. PAIRWISE R_1 CONCEPTS IN FUZZY BITOPOLOGICAL SPACES IN QUASI-COINCIDENCE SENSE by Md. Ruhul Amin, Md. Hannan Miah, Department of Mathematics, Faculty of Science, Begum Rokeya University, Rangpur, Rangpur, Bangladesh and Md. Sahadot Hossain, Department of Mathematics, University of Rajshahi, Rajshahi, Bangladesh. Email: ruhulbru1611@gmail.com

In this paper, we have defined some new notions of R1-separation in fuzzy bitopological spaces using quasi-coincidence sense. We have discuss the relations among our and other such notions. We have observed that all these notions satisfy good extension property. We have shown that these notions are preserved under the one-one, onto and FP-continuous mapping. Moreover, we have obtained productivity and some other properties of this new concept. Initial and final topologies are studied here in quasi-coincidence sense.

4. NORMAL SEPARATION ON FUZZY TOPOLOGICAL SPACES IN QUASI-COINCIDENCE SENSE by Saikh Shahjahan Miah, Department of Civil Engineering, Pundra University of Science & Technology, Rangpur, Bangladesh, M. R. Amin, Department of Mathematics, Begum Rokeya University, Rangpur, Bangladesh and Fazlul Hoque, Department of Mathematics, Pabna University of Science and Technology, Pabna, Bangladesh. Email: skhshahjahan@gmail.com

In this paper, we introduce three notions of normal property in fuzzy topological spaces by using quasi-coincidence sense and we establish relationship among ours and other such notions. We also show that all these notions satisfy Good extension property. It is observed that authors' concepts are preserved under one-one, onto, fuzzy open, fuzzy closed and fuzzy continuous mappings.

5. SEMI-TOTALLY G-BINARY CONTINUOUS FUNCTIONS IN G-BINARY TOPOLOGICAL SPACES by Nazir Ahmad Ahengar and J.K. Maitra, Department of Mathematics and Computer Sciences, R.D.V.V Jabalpur, M.P., India. Email:nzrhmd97@gmail.com, jkmrdvv@rediffmail.com

Recently the authors introduced the concept of binary topology and discussed some of its basic properties, where a binary topology from X to Y is a binary structure satisfying certain axioms that are analogous to the axioms of topology. We introduce the concept of semi-totally and pre-totally g-binary open functions in g-binary topological spaces in this paper. Further we introduce and study semi-totally g-binary continuous functions in g-binary topological space and investigate some of the properties of these functions.

6. SOME VARIANTS OF NORMALITY IN RELATIVE TOPOLOGICAL SPACES by Sehar Shakeel Raina and A. K. Das, Shri Mata Vaishno Devi

University, Katra, Jammu and Kashmir, India. Email: rainasehar786@yahoo.com, akdasdu@yahoo.co.in

In 1989 Arhangel'skii and Ganedi introduced the concept of relative topological properties. According to them with each topological property P one can associatea relative version of it formulated in terms of location of Y in X in such a natural way that when Y coincides with X then this relative property coincides with P. The concept of mild normality or -normality was introduced independently by Singal and Singal in 1973 and Stchepin in 1972. A few years earlier in 1969, Singal and Arya studied the concept of almost normality. V. Zaitsev in 1968 introduced the concept of quasi normal spaces while π-normality was studied by Lutfi. N. Kalantan in 2008. In this paper we have studied these concepts in relative sense.

7. A NEW DECOMPOSITION OF NORMALITY VIA A GENERALIZATION OF β-NORMALITY by A. K. Das, Pratibha Bhat and Ria Gupta, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir, India. Email:akdasdu@yahoo.co.in, pratibha87bhat@gmail.com, riyag4289@gmail.com

Normality plays a prominent role in general topology and behaves differently from other separation axioms in terms of subspace, preservation under mapping and product. Generalization of normality called β-normality was introduced in 2001by A. V. Arhangel'skii and L. D. Ludwig. They observe that β-normal pseudo- compact space is countably compact and β-normal space implies normal in class of -normal space. Kohli and Das introduced four generalizations of normality namely θ-normality, weak θ-normality etc. in 2002 and observed that all four variants of normality coincides in the class of θ-regular space. In this paper, we introduced the notion of weak β-normality which contains both the class of β-normality and θ-normality. We also observe that weak β-normality and weak θ-normality are independent notions but in class of weak θ-regular space, the class of weak β-normality contains the class of weak θ-normality. Further, factorization of normality in terms of weak β-normality in presence/absence of other separation axioms and subspaces of newly defined notion was also investigated.

8. ON SUPERINTEGRABLE MONOPOLE SYSTEMS by Md Fazlul Hoque, Department of Mathematics, Pabna University of Science and Technology, Pabna, Bangladesh.

One important class of superintegrable monopole models is Kaluza-Klein monopole sand its complete algebraic description which allows a dynamical symmetry of quantum motions. In fact models in space with Taub-NUT metric have attracted much attention and this metric is well-known to admit the Kepler-type symmetry and provides non- trivial generalization of the Kepler problems. In this talk, we overview new families of superintegrable Kepler, MIC-harmonic oscillator and deformed Kepler with Yang-Coulomb monopole systems in flat space and curved Taub-NUT space. We present their algebraically independent integrals of motion via direct and constructive approaches which show the superintegrability of the models. The integrals form symmetry algebras of the corresponding Hamiltonians with structure constants involving Casimir operators of certain Lie algebras. Such algebra approaches provide a deeper understanding to the degeneracies of the energy spectra and the connection of the wave functions with differential equations and differential geometry. In addition, we present our two recent projects: new extended Kepler-Coulomb quantum superintegrable and quasi-exactly solvable monopole interaction models from exceptional orthogonal polynomials and their algebraic properties. The review results are presented from our recent papers.

SECTION H: MEASURE THEORY

1. ON A NEW GENERALIZED INTUITIONISTIC FUZZY ENTROPY MEASURE by Surender Singh and Sonam Sharma, Shri Mata Vaishno Devi University, Katra, J & K, India. Email: surender.singh@smvdu.ac.in, sonamsharmaudh@gmail.com

Imprecision is an intrinsic characteristic of human behaviour. The concept of fuzziness is a well recognized mechanism to quantify the imprecision and ambiguity of human judgement. In last three decades, various extensions of fuzzy theory have been put forward. Intuitionistic fuzzy theory reveals some interesting aspects of approximate models. Intuitionitstic fuzzy entropy measures the average amount of imprecision and ambiguity present in an intuitionistic fuzzy set. In this work, we propose flexible (generalized) measure of intuitionistic fuzzy entropy and establish its superiority over some existing intuitionistic fuzzy entropy measures.

2. TIME-DEPENDENT PROBABILITIES OF A MULTI-SERVER QUEUING MODEL WITH CUSTOMERS' IMPATIENCE by Rakesh Kumar and Sapana Sharma, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir, India. Email:rakesh.kumar@smvdu.ac.in, sapanasharma736@gmail.com

In this paper we study the transient behavior of an M/M/c queuing system with reneging and retention of reneging customers. The probability generating function technique along with Bessel function properties is used to derive the time-dependent state probabilities explicitly.

3. ON USEFUL FUZZY KNOWLEDGE MEASURE AND ACCURACY MEASURE by Surender Singh and Sumita Lalotra, Shri Mata Vaishno Devi University, Katra, J & K, India. Email: surender.singh@smvdu.ac.in, rajputsumita88@gmail.com

In the real life problems comprising some ambiguity, the fuzzy entropy measures the average amount of ambiguity associated with the fuzzy set. On contrary to this, a fuzzy knowledge measure may be considered as average amount of precision present in a fuzzy set. In many decision-making problems, every element of the universe of discourse may not be equally important for the decision maker. Therefore, certain amount of usefulness may be linked with a particular member of universe of discourse. In this work, we introduce a useful knowledge measure and its generalization. The effectiveness of useful knowledge measure is demonstrated through comparative study. We also prove some properties of the generalized version of the useful fuzzy knowledge measure.

4. RELATIVE JENSEN-SHANNON DIVERGENCE MEASURE OF TYPE AND ITS PARTICULAR CASES by Ram Naresh Saraswat, Department of Mathematics and Statistics, Manipal University Jaipur, Rajasthan, INDIA. Email: sarswatrn@gmail.com

In this paper, we have considered some of his results using the unified relative Jensen-Shannon and arithmetic-geometric divergence of type and relating it with the new f-divergence measure. Applications of information inequalities have also considered.

SECTION I: NUMERICAL ANALYSIS, APPROXIMATION THEORY AND COMPUTER SCIENCE

1. A NEW LAYER RESOLVING MESH by Ramesh V. P., Mathematics and Analytics Center of Excellence (MACoE), Department of Mathematics, Central University of Tamil Nadu, India, Email: vpramesh@gmail.com

In this article, we present a harmonic function based a priori mesh, having more than one transition points resolving the layer region. The transition parameters are estimated based on a few arithmetic functions which uses the harmonic function and its compositions. We also used the ceiling function to restrict the domain to natural numbers while composing. The proposed arithmetic (mesh generating) functions are mostly many to one (not one-one) function giving computational efficiency. When compared to other existing meshes like modified Shishkin or Bakhvalov we can have more number of transition parameters hence making it better on resolving the layer.

2. APPROXIMATION BY (P, Q)-LUPA STANCU OPERATORS by Vinita Sharma, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email: vinita.sha23@gmail.com

In this paper, (p, q)-Lupas Bernstein Stancu operators are constructed. Statistical as well as other approximation properties of (p, q)-Lupa Stancu operators are studied. Rate of statistical convergence by means of modulus of continuity and Lipschitz type maximal functions has been investigated.

3. AN ALL QUADRILATERAL AUTOMESH GENERATION TECHNIQUE AND EXPLICIT INTEGRATION SCHEME TO SOLVE SOME ELLIPTIC BOUNDARY VALUE PROBLEMS by Suguntha Devi K, Department of Mathematics, Dr. T. Thimmaiah Institute of Technology, Kolar Gold Fields, India. Email: suganthadevik@yahoo.co.in

This paper proposes the explicit integration scheme for a unique linear convex quadrilateral which can be obtained from an arbitrary linear triangle. The explicit integration scheme proposed for these unique linear convex quadrilaterals is derived by using the standard transformations in two steps. We first map an arbitrary triangle into a standard right isosceles triangle by using an affine linear transformation. We discretise the standard right isosceles triangle in (u, v) space into three unique linear convex quadrilaterals. We can always map these linear convex quadrilaterals into a 2-square in a natural (ζ, η) space by an appropriate bilinear transformation. Using these two mappings, we have established an integral derivative product relation between the linear convex quadrilaterals in the global (x, y) space interior to the arbitrary triangle and the linear convex quadrilaterals of the local (u, v) space interior to the standard right isosceles triangle. Further, we have shown that the product of global derivative integrals $S^{i,j,e}$ in (x, y) space can be expressed as a matrix triple product $P(K^{i,j,e})P^T \times$ ($2*$ area of the arbitrary triangle in (x, y) space). We have found explicit integrals of the shape function and global derivative products as well as the product of shape functions. We use these integral values in computing stiffness matrix for some elliptic equations with constant coefficients. The findings confirm with surface plots of exact solutions for the considered elliptic boundary value problems.

4. HERMITE-MATRIX BASED EXPONENTIAL POLYNOMIALS by Shahid Ahmad Wani, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email: shahidwani177@gmail.com

The Hermite-matrix based exponential polynomials (HMEP) are introduced by combining Hermite matrix polynomials with exponential polynomials. Certain properties of the HMEP are also established. The operational representations providing connections between HMEP and some other special polynomials are also derived. The approach presented in this article is general.

5. THIRD ORDER WENO SCHEMES USING WEIGHT LIMITER

FUNCTIONS by Ritesh Kumar Dubey and Sabana Parvin, Research Institute & Department of Mathematics, SRM Institute of Science and Technology, Chennai, India. Email: riteshkumar.d@res.srmuniv.ac.in, sabanaparvin.s@res.srmuniv.ac.in

In this work, a new class of non-linear weights is proposed for constructing third order WENO schemes. These weights are devised using a function of smoothness parameter termed as weight limiter functions. The designing principle of these non-linear weights is completely different from the prevailing existing principle. A characterization of weights is done such that designed weights ensure non-oscillations at extreme points and achieves the critical values to yield third order accuracy of scheme in smooth solution region. Examples of weight limiter functions are also given and analyzed for well known required properties. Numerical results for various test problems are given to show the accuracy and shock capturing ability of the resulting scheme.

6. IMPROVED STRAIGHTFORWARD FORMULAE FOR EVALUATING SINGULAR INTEGRALS by Md. Habibur Rahaman, Dept. of Mathematics, Jagannath University, Dhaka, Bangladesh, M. Kamrul Hasan, Dept. of Mathematics, Rajshahi University of Engineering & Technology, Bangladesh, Md. Abdul Mannan Sheekh, Md. Abdul Gafur, Dept. of Mathematics, Adarsha Karigori & Banijjik College, Rajshahi, Bangladesh and Md. Ayub Ali, Dept. of Mathematics, Jagannath University, Dhaka, Bangladesh.
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The closed form Newton-Cotes formulae are not used directly for evaluating singular integral. Earlier extrapolation technique was used to obtain the functional values at the singular points. Recently, some straightforward formulae have been developed for evaluating singular integrals. In this article two improved straightforward formulae are presented for evaluating singular integrals. The new formulae give better results than others existing methods as well as Gauss quadrature formulae. The Romberg integration scheme of these formulae also converges faster.

7. APPROXIMATION PROPERTIES OF DURRMEYER VARIANT OF SZSZ OPERATORS INVOLVING MULTIPLE APPELL POLYNOMIALS by M. Mursaleen and Shagufta Rahman, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email: mursaleenm@gmail.com, rahmanshagufta14@gmail.com

In this article, Durrmeyer variant of Szsz operators involving multiple Appell polynomials are introduced. First, some basic results for convergence of the introduced operators are established and its rate of convergence is discussed by using modulus of continuity and class of Lipschitz function. Further, a Voronovskaja type theorem for the said operators is studied. Next, the approximation properties of these operators in weighted space are discussed. Some numerical examples with illustrative graphics have been added to justify the theoretical results and also compare the rate of convergence with the help of MATLAB.

8. EXPRESSION FOR ERROR IN APPROXIMATION IN TERMS OF $(M+1)^{TH}$ ORDER MODULUS OF SMOOTHNESS by Avinash Kumar Sharma, P.G. Deptt. of Mathematics Magadh University, Bodh Gaya and T. A. K. Sinha, Deptt. of Mathematics, S. M. D. College Punpun, Patna, Bihar. Email: ak95257016@gmail.com, thakurashok1212@gmail.com

In this paper we have obtained error in approximation by operator sequence $\{L_{n,m}(f,t)\}_{n\geq 1}$ in terms of $(m+1)^{th}$ order modulus of smoothness of function.

More precisely,

$$||\{L_{n,m}(f,t)\} - f(t)||_{L_p[0,1]} \leq cw_{m+1}\Big(f, \frac{1}{\sqrt{n}}, p, [0,1]\Big)$$

$$L_{n,m}(f,t) = (n+1)\sum_{v=0}^{n} p_{nv}(t)\int_0^1 p_{nv}(u)\Big\{\sum_{j=0}^{m}\frac{n^{\frac{j}{2}}}{j!}\prod_{i=0}^{j-1}\Big(t-u-\frac{i}{\sqrt{n}}\Big)\Delta^j f(u)\Big\}du$$

When $j=0$ the product is 1 and $p>1$

9. APPROXIMATION IN COMPACT SETS BY (P,Q)-BERNSTEIN-FABER POLYNOMIALS, $Q>P>1$ by M. Mursaleen and Ambreen Naaz, Department of Mathematics, Aligarh Muslim University, Aligarh, India. Email:mursaleenm@gmail.com, naaz.ambreen11@gmail.com

In the present article we introduce the (p,q)-Bernstein-Faber polynomials for $q>p>1$ attached to a compact set $O\subset C$ and to an analytic function on O. Here we prove that the approximation results by these operators can hold on larger compact sets. Also we give explicit formulas of Voronovskaja-type for the same operators.

10. SECOND ORDER COMPACT DIFFERENCE SCHEME FOR TIME FRACTIONAL SUB-DIFFUSION FOURTH-ORDER NEUTRAL DELAY DIFFERENTIAL EQUATIONS by Sarita Nandal and Dwijendra Narain Pandey, Department of Mathematics, Indian Institute of Technology Roorkee, Roorkee, India. Email: sarita.nandal7@gmail.com, dwijpfma@iitr.ernet.in

In this paper, we propose a compact difference scheme of second order temporal convergence for the analysis of sub-diffusion fourth-order neutral fractional delay differential equations. In this regard, a difference scheme combining the compact difference approach for spatial discretization along with $L_2-1\sigma$ formula for Caputo fractional derivative is constructed and analyzed. Unique solvability and unconditional stability and convergence of the proposed scheme are proved using the discrete energy method in L_2 norm. Established scheme is of second order convergence in time and fourth order convergence in spatial dimension i.e. $O(\tau^{3-\alpha}+h^4)$, where τ and h are time and space mesh sizes respectively and $\alpha\in(0,1)$ (fractional order of time derivative). Finally, some numerical experiments are given to show the authenticity, efficiency and accuracy of our theoretical results.

11. APPROXIMATION BY KANTOROVICH TYPE OPERATORS BASED ON BETA FUNCTION by Dhawal J. Bhatt, Applied Mathematics and Humanities Department, Sardar Vallabhbhai National Institute of Technology, Gujarat, India, Vishnu Narayan Mishra, Department of Mathematics, Indira Gandhi National Tribal University, Madhya Pradesh, India and Ranjan Kumar Jana, Applied Mathematics and Humanities Department, Sardar Vallabhbhai National Institute of Technology, Gujarat, India. Email: dhawalbhatt1031@yahoo.com, dhawal.bhatt@sxca.edu.in, rkjana2003@yahoo.com vishnunarayanmishra@gmail.com

In this paper, we develop a Kantorovich type operator based on beta function and study some fundamental properties of these operators. We also discuss approximation properties of a sequence of these operators using Korovkin theorem. We obtain the rate of approximation by using modulus of continuity. Moreover we study the convergence of these operators in a weighted space. The Voronovskaja type result for these operators is also discussed.

12. A COMPARATIVE STUDY OF MONITOR FUNCTION IN MESH

RECONSTRUCTION by Prabhat Mishra and Ritesh Kumar Dubey, SRM Institute of Science and Technology, Chennai, India.
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In this work new monitor functions are proposed using exponential function and compared with the existing prevailing monitor function in mesh adaptation algorithms for discontinuous flow problems. Different time integration methods are used to analyze the non-oscillatory property of the adapted mesh. It is found that monitor functions designed by exponential function is efficient and yields the solution in less number iterations of the mesh adaptation algorithm.

SECTION J: OPERATIONS RESEARCH

1. AN ALGORITHM FOR OPTIMAL SUSPENSION DESIGN OF A HALF-CAR MODEL IN TIME DOMAIN SYSTEM by Syeda Darakhshan Jabeen, Department of Mathematics, Birla Institute of Technology Mesra, Ranchi, India. Email:syed_sdj@yahoo.co.in, jabeen@bitmesra.ac.in

We present here an efficient algorithm for optimizing the suspension parameters of the half-car model. The algorithm is based on Split and Conquer Technique (SACT) administered by modified form of Artificial Bee Colony Algorithm (ABC). In the spit- ting phase, the search region is subdivided into subregions of smaller size. In each subregion the fitness value of optimizing function is identified by distinct groups of bees in ABC algorithm. The subregion with higher fitness is selected and one with lower fitness are discarded by the scout bee. The administrating phase allows bees to rule over the selected subregion and proceeds search for new region of the best food source. The SACT process is applied recursively to discover higher fitness subregion until division process terminates to a small interval holding the so far best solutions of the optimization problem. This scheme allows us to explore search region in an intelligent way, concentrating on the subregion containing high quality solution. The technique is simple, powerful and permits to focus on the best solution without much effort. Moreover, a new search strategy has been implemented to bias the bees towards feasible solution. To optimize the suspension parameters we formulate as a non-linear constrained optimization problem where the weighted sums of sprung mass jerk and tire deflections is minimized under technological constraints. We model the half car mode mathematically and minimize the level of vibration to enhance passengers comfort. Moreover, the results obtained by model simulations are compared with existing and optimized suspension parameters.

2. NEUTROSOPHIC GOAL GEOMETRIC PROGRAMMING PROBLEM AND ITS APPLICATION TO MULTI-OBJECTIVE RELIABILITY OPTIMIZATION MODEL by Tanmay Kundu and Sahidul Islam, Department of Mathematics, University of Kalyani, Kalyani, India. Email: tanmaykundu.math@gmail.com

This paper presents the goal geometric programming method in neutrosophic environment. Neutrosophic set is one of the most useful tools to express uncertainty, impreciseness in a more general way compare to fuzzy set and intuitionistic fuzzy set. Thus the proposed approach is described here as an extension of fuzzy goal geometric programming and intuitionistic fuzzy goal geometric programming .To demonstrate the methodology and applicability of the proposed approach, a multi-objective non-linear reliability optimization model is taken here and it is evaluated comparing the result obtained by the proposed method with the solution obtained

in intuitionistic fuzzy goal geometric programming technique at the end of this paper.

3. TRANSIENT ANALYSIS OF A SINGLE-SERVER QUEUEING SYSTEM WITH CORRELATED INPUTS by Rakesh Kumar and Bhavneet Singh Soodan, Shri Mata Vaishno Devi University, Katra, J & K, India. Email:rakesh.kumar@smvdu.ac.in, bhavneet5678@gmail.com

In this paper we study a continuous time single-server queueing system, wherein the arrivals at two consecutive transition marks are correlated and service process is exponential. The time dependent behavior of the model is studied using a numerical method.

4. TRANSIENT STATE ANALYSIS OF AN UNRELIABLE SERVER MACHINE INTERFERENCE QUEUEING MODEL WITH WORKING BREAKDOWN AND RETENTION by Sreekanth. K and Kamlesh Kumar, Department of Mathematics, Central University of Jammu, India. Email: sreekolledath@gmail.com, kamleshkum1984@gmail.com

In this paper we study a finite capacity Markovian machine interference problem with unreliable server under the F-policy. A random breakdown of the server may occur at any stage of the service to the system. It is also assumed that server does not stop completely its service to the failed machines in the system during breakdowns and the server continues the service to the failed machines with slower rate. We employ the Runge-Kutta method (4,5) to determine the different transient state probabilities and queueing system performance indices. The notion of retention and reneging of the failed machines are also been considered. In the end by altering the various queuing machining system parameters the system behavior is studied with the help of detailed numerical illustrations.

5. APPLICATION OF MATHEMATICA TO RELIABILITY OF CATTLE FEED PLANT by Shalini Jindal, Reena Garg, Department of Mathematics, YMCA University of Science & Technology, Faridabad, India and Tarun Garg, Satyawati College, University of Delhi, Delhi, India. Email:shalinijindal91@gmail.com, reenagargymca@gmail.com, tkgarg@satyawati.du.ac.in

The purpose of this paper, to analysis the reliability of cattle feed plant by using Mathematica under stated conditions. Model is developed by using Markov birth-death process. The cattle feed plant consists of seven units i.e. elevator, grinder, hopper, mixer, winch, palletiser and screw conveyor. The first order differential equations are derived by using model and then solved for comparative study of reliability to give accuracy in result. Graphical analysis of reliability is also studied.

SECTION K: SOLID MECHANICS, FLUID MECHANICS GEOPHYSICS AND RELATIVITY

1. PARTICLE CREATION COSMOLOGIES IN HIGHER DERIVATIVE THEORY by G.P. Singh, N. Hulke, Department of Mathematics, Visvesvaraya National Institute of Technology, Nagpur, India and Ashutosh Singh, Department of Applied Mathematics, Jabalpur Engineering College, Jabalpur, India. Email: gpsingh@mth.vnit.ac.in, nik19hulke@gmail.com, theprabhu.09@gmail.com

A new set of cosmological models with hybrid, intermediate and emergent form of scale factor in the presence of particle creation within framework of higher derivative theory have been discussed. The behavior of energy density, particle creation pressure, energy conditions and source function are also analysed with the help of graphical presentations.

2. A STUDY OF TWO DIMENSIONAL PROBLEM OF WAVE PROPAGATION IN TRANSVERSELY ISOTROPIC LAYERED THERMOELASTIC MEDIUM by Parveen Lata, Department of Basic and Applied Sciences, Punjabi University, Patiala, Punjab, India. Email: parveenlata@pbi.ac.in

In the present investigation, a plane SV(transverse) wave is made incident upon a layered transversely isotropic magnetothermoelastic solid of uniform thickness, interposed between two different semi-infinite elastic solids. The transversely isotropic magnetothermoelastic sandwiched layer is homogeneous with combined effects of two temperature, rotation and Hall current in the context of GN Type-II theory of thermoelasticity. The amplitude ratios of various reflected and refracted waves are obtained by using appropriate boundary conditions. The variation of various amplitude ratios with angle of incidence are depicted graphically. The effect of two temperature has been shown on the various amplitude ratios. Some cases of interest are also deduced from the present investigation.

3. EFFECT ON PROPAGATION OF ACCELERATION WAVES UNDER INUENCE OF AN OBLIQUE MAGNETIC FIELD by Raghwendra Singh, Department of Mathematics, Harcourt Butler Technical University, Kanpur, U.P., India, L. P. Singh, Department of Mathematical Sciences, I.I.T (B H U), Varanasi, India, Bhupendra Pratap, Department of Mathematics, NERIST, Nirjuli, Arunachal Pradesh India and Randhir Singh, Department of Mathematics, Birla Institute of Technology, Mesra, India. Email: raghwendra.singh47@gmail.com

In this paper we study the propagation of acceleration waves through a perfectly conducting inviscid gas subjected to an oblique magnetic field. The reference coordinate system for the study of the propagation of acceleration waves along characteristics path are formed by characteristics of the quasilinear system of equations. Transport equation is derived for growth and decay of an acceleration wave. Special attention is devoted to analyzing the effect of magnetic field components on the formation of the shock wave in both planar and cylindrically symmetric flows. Also, it is demonstrated that a linear solution of governing system of equations in the characteristic plane shows nonlinear behaviour in the physical plane.

4. RADIATION EFFECT ON MHD MIXED CONVECTIVE FLOW OF CU / CUO WATER NANOFLUIDS IN THE PRESENCE OF CHEMICAL REACTION by S. N. Gaikwad, Department of Mathematics, Gulbarga University, Kalaburagi, Karnataka, India. Email: sngaikwad2009@yahoo.co.in

The aim of the paper is to examine the singularity of heat and mass transfer of magneto - nanofluid flow past a vertical stretching sheet in presence of thermal radiation, magnetic effect and heat source. In this problem, the self - similarity transformations are considered to solve basic governing equations. Analytical perturbation technique is used to elaborate the coupled nonlinear ordinary differential equations. The reduced friction factor, local Nusselt and Sherwood numbers are explained in tabular form. To check the variation on the boundary layer nature, we have considered the two nanofluids namely, Cu-water and CuO-water based nanofluids. Influence of dimensionless parameters on velocity, thermal and concentration profiles are explained with the help of graphs and tables.

5. REFLECTION AT THE FREE SURFACE OF FIBER-REINFORCED THERMOELASTIC MEDIUM WITH TWO-TEMPERATURE LORD-SHULMAN MODEL by Sunil Kumar, Department of Basic and Applied Sciences, Bhagat Phool Singh Mahila Vishwavidyalaya, Sonepat, Haryana, India. Email: sunil.bpsmv@gmail.com

The purpose of the present investigation is to study the reflection of plane waves at free surface of fiber-reinforced anisotropic thermoelastic medium in the context of L-S model. It is found that there exist three sets of coupled waves in the medium. Using appropriate boundary conditions, the reflection coefficients and energy ratios of various reflected waves are computed numerically for a specific model and their variations with angle of incidence are presented graphically. Effect of two-temperature parameters on the reflection of generalized thermoelastic waves is noticed and depicted graphically. It has been verified that at each angle of incidence, there is no dissipation of energy at the free surface during reflection.

6. INVESTIGATION OF CROSS-DIFFUSION EFFECTS ON CASSON FLUID FLOW IN EXISTENCE OF VARIABLE FLUID PROPERTIES by R. Sivaraj, Department of Mathematics, School of Advanced Sciences, VIT, Vellore, India. Email: sivaraj.kpm@gmail.com

A numerical investigation has been carried out for coupled partial differential equations which describe varying fluid properties on unsteady, free convective chemically reacting fluid flow on a moving vertical cone and flat plate. The computations for flow, heat, and mass transport in presence of thermal radiation, viscous dissipation, Soret and Dufour effects are carried out using Crank-Nicolson scheme. The influence of various physical parameters on transport properties of the fluid is displayed in form of graphs and tables. The results elucidate that the consideration of variable fluid properties has a significant influence on the flow, heat and mass transfer characteristics. Strengthening the Casson fluid parameter tends to decelerate the fluid velocity and escalate the local skin friction.

7. BEHAVIOUR OF THERMAL STRESSES OF RECTANGULAR PLATE IN DIFFERENTIAL TRANSFORM DOMAIN by K. K. Chaudhari and S. Chandrashekhar, University of Mumbai, Maharashtra.
Email: kaminic2012@gmail.com

The present paper compromised with the study of thermal stress analysis of rectangular plate with no heat generation inside the plate in differential transform domain. The differential transform approach has been made to solve heat conduction as well as stress function, which gives the series solution. The thermal stress components are evaluated using stress function. Results are shown numerically and graphically.

8. ANALYTICAL STUDY OF THERMAL STRESSES WITH RESPECT TO INTERNAL MOVING POINT HEAT SOURCE IN A PLATE OF RECTANGULAR SHAPE by V. B. Patil, K. K. Chaudhari and S. Chandrashekhar, Dr. D. Y. Patil Campus Rait, Navi Mumbai.
Email: patilvijay.95@gmail.com

In this paper we analyses thermal stresses in thin plate of rectangular shape with respect to instantaneous moving point heat source about changing its position along the different axes and for given boundary conditions. The define problem can be solve by the integral transforms.

9. THERMOELASTIC INTERACTIONS IN A FIBER-REINFORCED ELASTIC MEDIUM UNDER G-L MODEL by Kapil Kumar Kalkal, Department of Mathematics, Guru Jambheshwar University of Science and Technology, Haryana, India. Email: Kapilkalkal_gju@rediffmail.com

The present manuscript is aimed at studying the propagation of plane waves in a fiber-reinforced, anisotropic, thermoelastic half-space under Green-Lindsay (G-L) model. A thermal shock is applied on the surface of the half-space which is taken to be traction free. The normal mode analysis is proposed to analyze the problem and

the physical quantities are established numerically and represented graphically in the presence and absence fiber-reinforcement. Effect of time on the physical fields is also observed. The datum of a finite speed of wave propagation is observed for each field. Some particular cases of interest have been deduced from the present investigation.

10. INFLUENCE OF VISCOSITY VARIATION AND SLIP VELOCITY ON FERROFLUID BASED JOURNAL BEARING by Jimit R. Patel, Department of Mathematical Sciences, P. D. Patel Institute of Applied Sciences, Charusat, Changa, Anand, Gu jarat, India. and G. M. Deheri, Department of Mathematics, Sardar Patel University, Anand, Gujarat, India. Email: patel.jimitphdmarch2013@gmal.com, gm.deheri@rediffmail.com

This paper deals with a theoretical analysis of the effect of viscosity variation on ferrofluid based Journal bearing considering slip velocity. The model of Tipai (1962, Ch 3) concerning viscosity variation is deployed here. The magnetic fluid flow is governed by Neuringer and Rosensweig model. To evaluate the effect of slip velocity, the Beaver's and Joseph's slip model has been considered. The pressure distribution is obtained after solving the associated Reynolds type equation, which gives the load carrying capacity. The computed results indicate that the magnetic fluid lubrication gets much help from the effect of viscosity variation except the situation of slip bearing more. There appears a considerable effect of slip on the performance characteristics.

11. SUCTION AND INJECTION EFFECT ON CASSON FLUID FLOW BETWEEN TWO PLATES USING SEMI ANALYTICAL METHOD by V. S. Sampath Kumar and N. P. Pai, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, India. Email: sampathamr322@gmail.com

The problem of rectilinear incompressible Casson fluid flow between two parallel infinite rectangular plates approaching or receding from each other with suction or injection at the porous plates. The governing Navier-Stokes equations are reduced to the fourth order non-linear ordinary differential equation through the similarity transformations. The approximated analytic solution based on the Homotopy perturbation method is given and also compared with the classical finite difference method. The effect of injection and suction on velocity profile, skin friction and pressure distribution is also discussed.

12. BLOOD-GOLD/COPPER NANOFLUID FLOW IN AN ORTHOGONALLY MOVING POROUS CHANNEL WITH VELOCITY SLIP AND THERMAL RADIATION EFFECTS by A. Subramanyam Reddy, Department of Mathematics, Vellore Institute of Technology, Tamil Nadu, India. Email: subramanyam.a@vit.ac.in

The present study deals with the nanofluid flow in a porous channel with expanding or contracting permeable walls in the presence of slip thermal radiation effects. In this work, blood is considered as a base fluid and gold (Au) / copper (Cu) as nanoparticles. The lower and upper walls of the channel are maintained at equal permeabilities. System of nonlinear ordinary differential equations is derived from the governing flow equations and is solved using homotopy analysis method. The obtained analytical solutions are in good accordance with the numerical solutions obtained using shooting method along with Runge-Kutta method. The influence of nanoparticle volume fraction, wall expansion ratio and slip parameters on the various flow variables have been discussed in detail.

13. THEORETICAL ANALYSIS THROUGH MATHEMATICAL MODELING OF TWO-PHASE FLOW TRANSPORT IN AN IMMOBILIZED-CELL PHOTOBIOREACTOR by T. Praveen, Department of Mathematics, School of Advanced Sciences, Vellore Institute of Technology (VIT), Vellore, India. Email: Praveen.t@vit.ac.in

Theoretical analysis of a reactiondiffusion process involved in packed bed photobioreactor with immobilized-cell is presented. Good approximate analytical expressions for the non-linear reaction diffusion equations for substrate and product concentrations are derived. Modified A domian decomposition method is used to derive the dimensionless concentration under steady-state condition. To see the efficiency, our analytical results are compared with the numerical results. For all different concentrations, the analytical results matched well with the simulated results. The close matching of simulated and the analytical data shows that our proposed solution is able to simulate the dynamic performance of system using the parameters.

14. STRESS DRIVEN HYDRODYNAMIC ROTATING BOUNDARY LAYER FLOWS AT THE FREE SURFACE by K. Jagadesh Kumar, Department of Mathematics, School of Advanced Sciences, Vellore Institute of Technology, Vellore, Tamil Nadu, India. Email: kjagadeeshkumar@vit.ac.in

Vertical boundary layers, which arise due to an azimuthal stress at the free surface of a linear, steady, axisymmetric, rotating fluid bounded below by a rigid surface, are analyzed using a combination of singular perturbation and boundary layer techniques. It is found that the interior azimuthal velocity is equal to the applied stress itself and the vertical mass flux pumped by the bottom Ekman layer enters directly into the free surface Ekman layer at the top. The vertical boundary layers are the usual Stewartson boundary layers namely, the E1/3 layer and the E1/4 layer, which arise to provide a return path for the Ekman mass flux and adjust the azimuthal velocity to its suitable value at the vertical boundary /discontinuity. However, In contrast to top rigid surface case, the Ekman mass flux cannot enter directly into the layer at the top free surface.

SECTION M: BIO-MATHEMATICS

1. COMPLICATED ENDEMICS OF AN SIR MODEL WITH A GENERALIZED INCIDENCE UNDER PREVENTIVE VACCINATION AND TREATMENT CONTROLS by Partha Sarathi Mandal, Department of Mathematics, NIT Patna, India. Email: partha.000@gmail.com

In this paper, we propose and study an SIR model that incorporates: (a) a preventive vaccination in the susceptible individuals; (b) different treatment control strategies depending on the infective population; and (c) a generalized incidence rate function describing mechanisms of the disease transmission. We provide rigorous mathematical results combined with numerical simulations of the proposed model including: (1) treatment control strategies can determine whether there is an endemic outbreak or not and the number of endemic equilibrium during endemic outbreaks, in addition to the effects of the basic reproduction number; (2) the large value of the preventive vaccination rate can reduce or control the spread of disease; and (3) the large value of the psychological or inhibitory effects in the incidence rate function can decrease the infective population. Some of our interesting findings are that the treatment strategies incorporated in our SIR model are responsible for backward bifurcations and multiple endemic equilibria; and the infective population decreases with respect to the maximal capacity of treatment. Our results may

provide us useful biological insights on population managements for disease that can be modeled through SIR compartments.

2. EFFECT OF INFORMATION INDUCED BEHAVIORAL RESPONSE AND TREATMENT ON INFECTIOUS DISEASES by Anuradha Yadav, THSTI University, India. Email: anuradha.2101@gmail.com

In this paper, we propose an SIRS model with treatment which also accounts for the individuals' behavior change due to the presence of information of the disease in the population. We assume that in the presence of information about disease prevalence susceptible individuals change their behavior and they use available protective measures to avoid infection. Thus these individuals become virtually immune to infection and hence move to recovered class. It is observed that limitations in medical resources lead to the existence of backward bifurcation. We also found that the information about disease prevalence helps in reducing the disease burden, whereas the treatment keeps infection at the low level with less infectivity period. In conclusion, both interventions work together very well in reducing the disease burden.

3. MODELING THE IMPACT OF CASE DETECTION IN THE TRANSMISSION OF TUBERCULOSIS USING HOLLING TYPE II FUNCTION by Akhil Kumar Srivastav and Mini Ghosh, Division of Mathematics, School of Advanced Sciences, Vellore Institute of Technology, Chennai, India. Email:akhilkumar.srivastav2016@vitstudent.ac.in, minighosh@vit.ac.in

Tuberculosis (TB) is a contagious disease which can cause death. In this paper, a non-linear model is proposed and analyzed by considering Holling type II function for the incidence rate. Additionally, impact of media is incorporated by including an exponential decay factor in the class of detected individuals. The basic reproduction number R0 is computed. All possible equilibria of the models are obtained and stability of these equilibria are discussed in details. The proposed model exhibits backward bifurcation for some set of parameters, which suggests that reducing R0 below one is not enough to make disease-free equilibrium to be globally stable. Numerical simulations are presented to illustrate our analytical findings. Finally, the proposed model is extended to optimal control problem by introducing one control parameter in the transmission term. The results of optimal control model are compared with the results of model without control using numerical simulation. From the simulation results, it is found that the optimal control model gives better result.

SECTION N: HISTORY AND TEACHING OF MATHEMATICS

1. GREAT MATHEMATICAL DISCOVERIES MADE IN INDIA, BUT NOT CREDITED TO INDIAN MATHEMATICIANS by Sudhir Pujara, D.B.G. Government College, Panipat, India. Email: sudhirpujaramaths@gmail.com

The culture, religion, arts, science and literature of India has always been so rich that a huge number of historians have written about the great history of India. India also has a vast history of development of mathematical ideas. There have been some great discoveries in the field of mathematics in India from ancient period to the modern times that have changed the world. Earliest recordings of mathematics in India come from the Sulbasutras of Vedic period. The Sulbasutras were primarily written for religious purposes. But Sulbasutras provided great insights to the geometry and the geometrical shapes, which were used in the construction of altars and temples.

An effort has been made in this paper to discuss some great mathematical discoveries in India, which are actually credited to some European or other mathematicians. For example, Indian mathematician Baudhayana had given the Pythagoras

theorem at least 200 years before Pythagoras was even born. Bhaskaracharya had discovered many ideas of Leibniz about 500 years earlier than him. Diophantine equations should actually be called as Bharamgupta-Bhaskara equations because of their enormous contribution in finding the solutions of Diophantine equations. Other important achievement comes from Kerala school of astronomy and mathematics, which is the contribution of Madhava to the study of infinite series who gave the infinite series for , sine, cosine and arctangent nearly 250 years before Newton, Gregory and Leibniz did.

2. ALGEBRAIC REPRESENTATION OF VINCULUM AND GENERALIZED RULE FOR VINCULUM STRUCTURE by D. N. Garain and Sanjeev Kumar, S.K.M. University, Dumka, Jharkhand, India.
Email: dn_garain@rediffmail.com, sanjeev.aryu@gmail.com

The term 'Vinculum' plays an important role in Vedic Mathematics. It makes the digits over 5 to less than 5. So calculation becomes easier due to less probability of appearance of carry number. In the present study the concept of vinculum has been expressed by framing generalized algebraic structure with suitable logic.

3. USE OF INTERNET AND TECHNOLOGY IN SPREADING OF MATHEMATICS TEACHING by Kuheli Biswas and Sanjib Kumar Datta, Department of Philosophy, University of Kalyani, West Bengal, India. Email: 100kuhelibiswas@gmail.com, sanjibdatta05@gmail.com

The Internet is not just one more point in the long continuum of inventions, but a moment of real transformation which is now beginning to be appreciated. Although many of the earlier inventions like radio, film or television had a great impact on the society, they had a relatively insignificant influence on serious as well as advanced education. The same is not expected to hold good in case of the Internet because of the compatibility between processes of the Internet and those of higher levels of training. Mathematics education discourse routinely promotes the idea that mathematics is everywhere. That mathematics is everywhere seems a reasonable implication of We all use math every day. A modern technology, mostly in the form of computational devices and control systems is often cited as evidence of the omnipresence of mathematics. In this paper different aspects of internet based mathematics teaching are discussed.

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