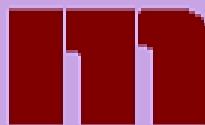




INDIAN



MATHEMATICAL



SOCIETY

INDIAN MATHEMATICAL SOCIETY

(Founded in 1907; Reg. No. S-550, Delhi)

Registered Office: Department of Mathematics,
Savitribai Phule Pune University, Pune-411007

<http://www.indianmathsociety.org.in>

NEWSLETTER

NO. 35

April – 2016



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.

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IMPORTANT EVENTS

- (1) The ensuing 82nd **Annual Conference** of the Society will be held under the auspices University of Kalyani, Kalyani, West Bengal during December 27-30, 2016. Prof. Sanjib Kumar Datta, Department of Mathematics, University of Kalyani will be the Local Organizing Secretary. His email id is *sanjib.datta@yahoo.co.in*.
- (2) **Prof. D. V. Pai**, Department of Mathematics, IIT Gandhinagar, Gujarat has been elected as the **President** of the Indian Mathematical Society for a period of one year with effect from **April 1, 2016**.
- (3) **Dr. S. P. Tiwari**, (Indian School of Mines, Dhanbad) and **Prof. P. Veermani**, (IIT, Chennai) have been elected as **members of the Council** for a period of three years with effect from **April 1, 2016**.
- (4) **Prof. A. K. Agarwal Award** for 2014 has been awarded to **Ms. Neena Gupta**, Math-Stat Division, Indian Statistical Institute, Kolkata for her paper entitled "On the cancellation problem for the affine space A^3 in characteristic p " published in *Inventiones Mathematicae* 195 (2014), 279–288.
- (5) The Volumes 82(1-4) (2015) and 83(1-2) (2016) 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.
- (6) The seventh Asian Mathematical Conference (AMC 2016) will be held in Bali, Indonesia during July 25-29, 2016. The members of IMS are encouraged to participate in the conference. The details of the conference is available on the website www.amc2016.org.
- (7) The last date for the submitting the papers for Prof. A. K. Agarwal Award for the year 2015 and Prof. A. M. Mathai Award for the year 2015 is April 30, 2016.

HIGHLIGHTS OF THE 81ST ANNUAL CONFERENCE

The 81st Annual Conference of the Indian Mathematical Society was held at the Visvesvaraya National Institute of Technology (VNIT), Nagpur, Maharashtra during December 27-30, 2015 under the president-ship of Prof. A. M. Mathai, Director, centre for Mathematical and Statistical Sciences PeechiCampus, KFRI, Peechi-680653, Kerala, India and Emeritus Professor of Mathematics and Statistics McGill University, Montreal, Canada, H3A 2K6. The Conference was attended by more than 200 delegates. Two presidential addresses (General and Technical), one plenary lecture, by Prof. V. Srinivas, TIFR Mumbai, five Memorial Award lectures and eleven invited lectures were delivered. Also, six Symposia were organized during the conference and thirty invited speakers gave talks in the Symposia. Moreover, in all 127 research papers were accepted for presentation at the Conference including 15 research papers for the paper presentation competition for various prizes.

The Conference was inaugurated by Prof. Narendra Chaudhari, Director, VNIT, Nagpur. The function was presided over by Prof. A. M. Mathai. Prof. S. R. Sathe, Professor of Computer Science and Convener of the Conference, VNIT, 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. N. K. Thakare also reported the academic programmes of the Conference.

Prof. A. M. Mathai delivered his Presidential address (General) on the topics “Proliferation of Scientific/Professional Societies and India’s share of World Contribution in Mathematical Sciences”. The function ended with a vote of thanks by the Local Organizing Secretary, Dr. G. P. Singh.

Prof. A. M. Mathai gave Presidential address (Technical) on “A Versatile Author’s Contributions to various Area of Mathematics, Statistics, Astrophysics, Biology and Social Sciences” which was presided over by Prof. Satya Deo, Editor of the Journal of Indian Mathematical Society.

Prof. V. Srinivas, TIFR, Mumbai delivered a **Plenary Lecture** on “Complete intersection points on affine varieties and 0-cycles”.

The 29th **P. L. Bhatnagar Memorial Award Lecture** was delivered by Prof. V. D. Sharma, IIT, Mumbai on “Evolution and asymptotic behavior of nonlinear hyperbolic waves”.

The 26th **V. Ramaswami Aiyar Memorial Award Lecture** was delivered by Prof. Uttara V. Naik Nimbalkar, IISER, Pune on “Likelihood, Estimating Functions and Generalized Method of Moments”.

The 26th **Srinivasa Ramanujan Memorial Award Lecture** was delivered by Prof. P. Sankaran, IMSc, Chennai on “Twisted conjugacy in groups of PL-homeomorphisms of the reals”.

The 26th Hansraj Gupta Memorial Award Lecture was delivered by Prof. B. Sury, ISI, Bangalore on “Generating matrix groups over nice rings”.

The 12th **Ganesh Prasad Memorial Award Lecture** was delivered by Prof. N. T. Nair, IIT, Chennai on “Compact operators and Hilbert scales in ill-posed problems”.

A. Narasinga Rao Memorial Prize was awarded to Dr. Sanjay Kumar, Deenbandhu Chhotu Ram University of Sci. & Tech., Sonapat, for the best paper published in the Journal of the Indian Mathematical Society in the year 2012.

P. L. Bhatnagar Memorial Prize for 2015 has been awarded to Mr. Jeet Mohapatra (Odisha) for being the top scorer for the Indian Team at the 56th International Mathematics Olympiad (IMO) held at Chiang Mai, Thailand during July 4-16, 2015.

Various prizes for the Paper Presentation Competition:

A total of 15 papers were received for Paper Presentation Competition for Six IMS Prizes, AMU Prize and V. M. Shah Prize.

Prof. Satya Deo (Chairperson), Prof. J. R. Patadia, Prof. M. M. Shikare, Prof. Ahmed Ali and Prof. Girija Jayaraman were the judges.

Following is the result for the award of these prizes.

IMS Prize - Group-1: There were 2 presentations and the prize was awarded to B. R. Srivastava Kumar, Manipal Institute of Technology, Manipal.

IMS Prize - Group-2: There was 1 presentations and the prize was not awarded.

IMS Prize - Group-3: No presentation.

IMS Prize - Group-4: There was 1 presentations and the prize was awarded to J. P. Chauhan, SVNIT, Surat.

IMS Prize - Group-5: There was 1 presentations and the prize was awarded to Binaya K. Bishi, VNIT, Nagpur.

IMS Prize - Group-6: There were 2 presentations and the prize was awarded to R. L. Das, SVNIT, Surat.

AMU Prize: There was 1 presentations and the prize was NOT awarded.

V M Shah Prize: There were 3 presentations and the prize was awarded to Lakshika Chutani, Netaji Subhas Institute of Technology, New Delhi.

Invited Lectures delivered

(i) Edy Tri Baskoro, Faculty of Mathematics and Natural Sciences, Bandung, Indonesia: On almost Moore digraphs.

(ii) Yaokun Wu, Shanghai Jiao Tong University, Shanghai, China: Graph dynamical system.

(iii) Anupam Kumar Singh, IISER, Pune: A Membership test for the classical groups.

(iv) B. N. Waphare, SPPU, Pune: Amartya Sen's mathematical approach to social choice theory

(v) K.C. Deshmukh, R.T.M. Nagpur University, Nagpur: Some generalized thermoelastic problems with heat supply in a solid cylinder.

(vi) A.K. Chaturvedi, University of Allahabad, Allahabad: Retractable and related modules.

(vii) Sanjay Amrutiya, IIT, Gandhinagar : Moduli of quiver representations and its applications.

(viii) J.S.V.R. Krishnaprasad, M. J. College, Jalgaon: Low Reynolds number flow in tubes of varying cross-section.

(ix) Rakesh Katare, Department of Computer Science, APS University: Interconnection network-A special reference to perfect difference network.

(x) Aruna Tiwari, Computer Science and Engineering, IIT, Indore : Design of intelligent scalable learning algorithms for handling Big Data in soft-computing frameworks.

(xi) Ramchandra P. Bhavsar, School of Computer Sciences, North Maharashtra University, Jalgaon: Verb morphology and demand frame generator Hindi and Marathi languages.

(xii) Nishchol Mishra, School of Information Technology, Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal: Big Data analysis in the issues of social media content.

(xiii) Mahesh Pawar, Department of Information and Technology, UIT, RGPV, Bhopal: Introduction to Big Data and Hadoop technology.

(xiv) S.P. Tiwari, Indian School of Mines, Dhanbad: Fuzzy rough sets and fuzzy topologies.

(xv) Rajeev Wankar, School of Computer and Information Sciences, University of Hyderabad, Hyderabad: Future Research and Business Trends in Cloud Computing.

Symposia organized

(i) Recent Advances in Complex Analysis.

Convener: A. P. Singh, Central University, Rajasthan.

Speakers : A. P. Singh, I. Lahiri (Kalyani University, West Bengal),

Om Ahuja (Kent State University, Ohio, U.S.A.).

(ii) Fractional Calculus: Current Trends.

Convener: V. S. Daftardar-Gejji (SPPU, Pune).

Speakers: A. M. Mathai (McGill University, Canada), K. Balachandran (Bharathiar University, Coimbatore), Kiran Kolwankar (Jhunjhunwala College, Mumbai), Sachin B. Bhalekar (Shivaji University, Kolhapur), Varsha Daftardar-Gejji.

(iii) Global Differential Geometry.

Convener: Mukut Mani Tripathi, BHU, Varanasi.

Speakers : Arindam Bhattacharyya (Jadavpur University, Kolkata), Rakesh Kumar (Punjabi University, Punjab), H.G. Nagaraja (Bangalore University, Bangalore), N. Uday Kiran (Sri Sathya Sai Institute of Higher Learning Prashanthi Nilayam, Puttaparthi, Andhra Pradesh), Mukut Mani Tripathi.

(iv) Algorithmics and Graph Theory.

Convener: Manish P. Kurhekar, Dept. of Comp. Sci. and Engg., VNIT, Nagpur.

Speakers: Bharat Adsul (IIT Bombay, Mumbai), Meghana Nasre (IIT Madras, Chennai), Vinayak D. Pandit (IBM India Research laboratory, Bengluru).

(v) Cryptography and Security.

Convener: Ravindra B. Keskar, Dept. of Comp. Sci. and Engg., VNIT, Nagpur.

Speakers: Geetam Tomar (Machine Intelligence Research Lab, Gwalior), Chester Rebeiro (IIT Chennai), Ankur Panchbudhe (CTO, Vaultize Pune).

(vi) Relativity.

Convener: Dr. G.P. Singh, Department of Mathematics, VNIT, Nagpur.

Speakers: Subenoy Chakraborty (Jadavpur University, Kolkata), Ram Gopal Vishwakarma Unidad Acadmica de Matemáticas (Universidad Autónoma de Zacatecas, ZAC Mexico), Anirudh Pradhan (G L A University, Mathura, U. P.), R. Chaubey (BHU, Varanasi), T. Singh (BHU, Varanasi).

MINUTES OF THE 81st ANNUAL GENERAL BODY MEETING OF THE INDIAN MATHEMATICAL SOCIETY

The Annual General Body Meeting of the Indian Mathematical Society was held on Wednesday, the 30th December 2015 at 12 noon in the Auditorium of the Visvesvaraya National Institute of Technology (VNIT), Nagpur under the presidentship of Prof. A. M. Mathai. The following business was transacted.

Item No. 1. To confirm the Minutes of the General Body meeting held on Tuesday, December 30, 2014 at 12.15 p.m. in the Golden Jubilee Auditorium of the Indian School of Mines, Dhanbad, Jharkhand The Minutes of the General Body meeting held on December 30, 2014 at 12.15 pm at Dhanbad were confirmed.

Item No. 2. To receive the report of the General secretary for the year 2015.

Report of the General Secretary for the year 2015.

(i) The IMS News Letters - No. 33 in March 2015 and No. 34 in August 2015 - were published. They 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.

(ii) The meeting of the Academic Planning Committee for the IMS Conference 2015 was held on Sunday, the 5th July 2015 from 11.00 am in the conference room of the Guest House of the Savitribai Phule Pune University, Pune. The meeting was presided over by Prof. A. M. Mathai. The names for five memorial award lectures,

plenary talks, invited talks, list of Symposia and their conveners were finalized in the meeting.

(iii) The meeting of the office bearers of the IMS (Gen. Sec., Adm. Sec., Treasurer) and the representatives (S. A. Praveen, Somashekar) of the Informatics (India) Ltd., Bangalore concerning online publication of JIMS, was held on 4th June 2015 at 11.00am in the Library, Department of Mathematics, Savitribai Phule Pune University, Pune.

(iv) The contract agreement relating to online publication of JIMS has been signed between Indian Mathematical Society and the Informatics Publishing Limited, Bangalore on June 4, 2015. On behalf of the IMS, the agreement is signed by the General Secretary Prof. N. K. Thakare and the Administrative Secretary Prof. M. M. Shikare while on behalf of the Informatics Publishing Limited it is signed by Mr. S. A. Praveen and Mr. Jagannath. The Volume 82, 2015 is now available online on the website of Informatics Publishing Limited.

(v) A committee of Prof. Satya Deo, Prof. J. R. Patadia and Prof. M. M. Shikare was appointed to recommend the name of the author of the best research paper (published in JIMS and Math Student during 2013) for the award of A. Narasinga Rao Memorial Prize for the year 2013. The committee has recommended Dr. Ajit De, Department of Mathematics, Siliguri College, Siliguri (W. B.) for this award for his paper entitled "Computation of Synthetic Seismogram for a buried elliptic in plane shear dislocation model in an elastic half-space" published in the Journal of the Indian Math Soc., Vol 80 (3-4), 243-263.

(vi) Terms and conditions for awarding A. K. Agarwal Award and also A. M. Mathai Award were formulated in consultation with the office bearers of the IMS.

(vii) A panel of five mathematicians was formulated to evaluate the papers received for Prof. A. K. Agarwal Award for best publication in the year 2014. The panel included Prof. Bruce Berndt (University of Illinois, USA), Prof. D. V. Pai (IIT, Gandhinagar), Prof. Manjul Gupta (IIT, Kanpur) and Prof. S. Tariq Rizvi (The Ohio State University, USA), Prof. A. P. Singh (Central University, Rajasthan). Each member of the panel was requested to use 1-10 scale system to evaluate the papers. Individual reports were received from the referees. The reports were compiled. The **Prof. A. K. Agarwal Award** for 2014 was awarded to **Ms. Neena Gupta**, Math-Stat Division, Indian Statistical Institute, Kolkata for her paper entitled "On the cancellation problem for the affine space A^3 in characteristic p " published in *Inventiones Mathematicae*, 195 (2014), 279-288.

(viii) **P. L. Bhatnagar Memorial Prize** for 2015 has been awarded to Mr. Jeet Mohapatra (Odisha) for being the top scorer for the Indian Team at the 56th International Mathematics Olympiad (IMO) held during July 4-16, 2015 at Chiang Mai, Thailand.

(ix) During the year of the report 130 new life members were enrolled, besides 30 persons became session members of the IMS for 2015 conference.

(x) A timely guidance and the help has been provided to Dr. G. P. Singh, Local organizing secretary of the 2015 IMS conference pertaining to raising of funds, local arrangements and inaugural function of the conference.

(xi) Guidance and the help was provided from time to time to Dr. M. M. Shikare, the Academic Secretary (I/C), IMS for preparing the Academic Programme of the Nagpur conference.

(xii) 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.

(xiii) 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.

(xiv) The General Secretary thanks Prof. M. M. Shikare for extending substantial help in performing the duties of the general secretary.

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

Item No. 3. To receive the Report of the Academic Secretary 2015.

The Academic Secretary, Prof. M. M. Shikare presented the brief report on the academic activities for the year 2015.

(1) The meeting of the Academic Planning Committee (APC) of the IMS was held in the meeting room of the Savitribai Phule Pune University, Pune on July 5, 2015. The meeting was presided over by Prof. A. M. Mathai, President of the IMS. The names of the five memorial award lecturers, plenary speakers, invited speakers, the topics of the symposia and their conveners were decided as per the following details.

(a) Memorial Award lectures:

(i) 26th Hansraj Gupta Memorial Award Lecture, Prof. B. Sury, Stat-Math Unit, Indian Statistical Institute, Bangalore.

(ii) 26th V. Ramaswami Aiyer Memorial Award Lecture, Prof. Uttara V. Naik Nimbalkar, SPPU, Pune.

(iii) 29th P. L. Bhatnagar Memorial Award Lecture, Prof. V. D. Sharma, IIT Bombay, Mumbai

(iv) 26th Srinivasa Ramanujan Memorial Award Lecture, Prof. Parameswaran Sankaran, Institute of Mathematical Sciences, CIT Campus, Taramani, Chennai.

(v) The 12th Ganesh Prasad Memorial Award Lecture, Prof. M. T. Nair, IIT, Chennai.

(b) Invited talk (One hour):

Prof. Edy Tri Baskoro, Institut Teknologi Bandung (ITB), Bandung, Indonesia

(c) Invited talks (half an hour):

(i) Prof. Yaokun Wu, Shanghai Jiao Tong University, Shanghai, China.

(ii) Dr. Anupam Kumar Singh, Mathematics, IISER, Pune.

(iii) Prof. B. N. Waphare, SPPU, Pune.

(iv) Prof. K. C. Deshmukh, R. T. M. Nagpur University, Nagpur.

(v) Prof. Avinashkumar Chaturvedi, Allahbad University.

(vi) Dr. Sanjaykumar Amrutiya, IIT, Gandhinagar.

(vii) Dr J. S. V. R. Krishnaprasad, M. J. College, Jalgaon.

(viii) Dr. S. P. Tiwari, Indian School of Mines, Dhanbad.

(d) Symposia and their conveners:

(i) Recent Advances in Complex Analysis (Convener: A. P. Singh, Central University, Rajasthan)

(ii) Fractional Calculus: Current Trends (Convener: V. S. Gejji, SPPU, Pune)

(iii) Global Differential Geometry (Convener: Mukut Mani Tripathi, BHU, Varanasi)

(iv) Algorithms and Graph Theory (Convener: Manish P. Kurhekar, VNIT, Nagpur)

(v) Cryptography and Security (Convener: Ravindra B. Keskar, V.N.I.T, Nagpur)

(v) Relativity (Convener: G. P. Singh, VNIT, Nagpur)

(e) Panel Discussion

Topic : Choice Based Credit System

Convener: Satya Deo

Panelists:

1. Prof. S. S. Khare, Ex Pro Vice Chancellor, North Eastern Hill University, Shillong.
2. Prof. S. B. Nimse, Vice Chancellor, Lucknow University.
3. Prof. N. K. Thakare, Ex Vice Chancellor, North Maharashtra University, Jalgaon.
4. Prof. Satya Deo, Ex Vice Chancellor, Rani Durgavati Vishwavidyalaya, Jabalpur and Awadhesh Pratap Singh University, Rewa.
5. Prof. H. P. Dikshit, Ex Vice Chancellor, Indira Gandhi National Open University.
6. Prof. V. P. Saxena, Ex Vice Chancellor, Jiwaji university, Gwalior.

(2). The invitations were sent to the above mathematicians providing them necessary details concerning the organization of the conference. They were requested to send the titles and the brief abstracts of their talks to the Local Organizing Secretary. The conveners of the Symposia were requested to identify the speakers of the Symposia and get the titles and abstracts of their talks. Scanned copies of the invitation letters were sent to Prof. Yaokun Wu and Prof. Edy Tri Baskoro.

(3). In all 112 papers have been received for oral presentations in the Conference while 15 papers have been received for various prizes. Each paper was scrutinized for its acceptance / non-acceptance for presentation in the conference. Five papers were not found suitable and were not accepted for presentation in the conference. The abstracts of the papers (in the form of soft files) were sent to Dr. G. P. Singh, the Local Organizing Secretary of the 81st conference, for printing them in the abstracts booklet of the conference.

(4). The Academic programme of the conference was prepared in the month of October 2015. The programme has been displayed on the website of the Indian Mathematical Society.

Item No. 4. To receive the report of the Administrative Secretary for the year 2015.

Report of the Administrative Secretary for the year 2015.

(i) E-mails of thanks and appreciations were sent to the speakers of the Memorial Award lectures, Invited talks and conveners of the Symposia, local organizing secretary of the 80th Annual Conference of IMS held at Dhanbad in Dec. 2014. Prof. A. M. Mathai was informed of his election to the post of President of the IMS. Elected council members were informed accordingly.

(ii) The Minutes of the council meeting and the general body meeting held at Dhanbad were prepared.

(iii) An arrangement was made on 4th June 2015 at the Department of Mathematics, Savitribai Phule Pune University (SPPU) for holding the meeting (concerning on line publication of JIMS) between the office bearers of IMS and the representatives of the India Publishing Limited (IPL), Bangalore.

(iv) A couple of meetings and discussions were held with Advt. Rajebhosale, Pune in order to verify the legal aspects of the contact agreement that is signed between IMS and IPL regarding online publication of JIMS.

(v) An arrangement was made to get the contract agreement (for online publication) signed by the office bearers of IMS and the representatives of the IPL.

(vi) The print copies of JIMS Volume 82, nos. 1-2 (January - June 2015) and JIMS Volume 82, nos. 3-4 (July-Dec. 2015) were received from Parashuram Process, Pune and preserved in the Library of the Mathematics Department, Savitribai Phule Pune University, Pune. The camera ready copy of The Math. Student, Vol. 84, Numbers 1-4, (2015) was 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. Dept., SSPU.

(vii) The copies of JIMS Vol. 82 (Nos. 1-2) (2015), Vol. 82 (Nos. 3-4)(2015) and The Mathematics Student (Nos. 1-2) (2015) have been sent to the subscribing institutes and Universities by registered parcels. The account of corresponding expenses has been maintained.

(viii) Arrangements were made for holding the meeting of the Academic Planning Committee on Sunday, the 5th July 2015 from 11.00am in the conference room of the Guest House of the Savitribai Phule Pune University, Pune.

(ix) IMS News Letter Nos. 33 and 34 were prepared and sent by e-mails to the life members of the IMS (with the help of the assistant).

(x) Invitation was sent to Mr. Jeet Mohapatra (Odisha) for attending the Inaugural function of IMS and receiving the P. L. Bhatnagar memorial prize awarded to him.

(xi) An arrangement has been made to bring the copies of The Math Student Vol. 84 (3-4, 2014) for release in the inaugural function of the 81st Annual conference of IMS.

(xii) 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, General body meeting etc. have been maintained.

(xiii) Substantial help was rendered to the General Secretary Prof. N. K. Thakare in the finalization of Newsletter Nos. 33 and 34.

Item No. 5. To consider the Audited Statement of Accounts for the year 2014-2015 and budget for the year 2016-2017.

The Audited Statement of Accounts for the year 2014-2015 and budget for the year 2016-2017 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 2015.

Report of the Editor, Journal of the Indian Mathematical Society (2015).

Manuscript Status:

(a) Number of papers pending with the referee or under process at the end of 2015:	19
(b) Number of manuscripts received during the year 2015:	71
Total:	90
(i) Number of Manuscript accepted during 2015:	12
(ii) Number of manuscript rejected during 2015:	22
(iii) Number of manuscript with the referees during 2015:	56
Total:	90

Publication Status (print):

Volume 82(1 - 2) 2015 of the Journal of the Indian Mathematical Society was released during the Inaugural function of the Society in Dec 2014 and sent to the subscribers in Jan 2015. Volume 82 (3 - 4) 2015 of the Journal of the Indian Mathematical Society was released in September 2015 and sent to the subscribers. Volume 83 (1-2) 2016 is under preparation for release in Jan/Feb 2016.

Publication status (online): The Informatics India LTD people have started the online publication of JIMS by putting vol. 82 (1-2) and (3-4) online. The back volumes are yet to be put online.

Acknowledgements: The Chief Editor, JIMS puts on record his grateful thanks to the members of the Editorial Board of JIMS, referees of research papers from India and abroad for their assistance and support to JIMS. The editor also expresses his sincere thanks to the Treasurer of IMS, Prof. S. K. Nimbhorkar and the Administrative Secretary Prof. M. M. Shikare for providing valuable assistance in the overall publications and dispatch of JIMS.

Item No. 7: To receive the report of the Editor, Mathematics Student for 2015.

Report of the Editor of The Mathematics Student for 2015.

Status of Initiatives taken:

It may be recalled that in view of the suggestions mainly by Prof. Bruce C. Berndt and some other well wishers of our Society and online discussions with them since July 2013 to make the Mathematics Student more student oriented, the following initiatives, to begin with, were discussed and approved for implementation in the last IMS Council meeting at Dhanbad.

The printing of the abstracts of the papers presented at the annual conferences of the Society be discontinued from the 2015 issue of the Mathematics Student onwards.

The Problem Section targeting students and researches be started.

Frequency of publication be changed from One to Two, like JIMS.

It is a matter of great pleasure to announce that we have been successful in implementing all these three initiatives thanks to the excellent support from the Editorial Board members, their colleagues and other members of the mathematics community.

Publication Status:

The soft copy of the Vol. 84, Nos. 1- 2, January-June (2015) of The Mathematics Student was sent on line in June 2015 and that of the Vol. 84, Nos. 3- 4, July-December (2015) of The Mathematics Student was sent on line just few days before to all the Life Members (who have registered their E-mail id on line on ims-goesgreen@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 website as well.

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

Manuscript Status:

67 manuscripts are received during the period from December 24, 2014 to December 23, 2015 and 19 manuscripts were reported as pending with the referees in the last report.

Of these total 86 manuscripts, 26 are accepted, 49 are not accepted and 11 are

pending with the referees.

Acknowledgements: The Editor take this opportunity to put on record our sincere thanks and profuse gratefulness to the 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.

The Editor also expresses our sincere thanks to the Administrative Secretary Prof. M. M. Shikare and the Pune Press for their assistance in getting the Vol. 84, Nos. 1-2, January-June (2015) as well as the Vol. 84, Nos. 3-4, July-December (2015) of the Mathematics Student printed, and thus in its timely publication.

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

Item No. 8: To consider the venue of the 82nd Annual Session of the society to be held in 2016.

The IMS accepted the firm invitation from the Hon. Vice Chancellor, University of Kalyani, Kalyani, West Bengal for organizing the 82nd Annual Conference of the Indian Mathematical Society. Prof. Sanjib Kumar Datta, Department of Mathematics, University of Kalyani will be the Local Organizing Secretary.

Item No. 9: Announcements of the results of the following elections:

- (i) President for the year 2016-2017;
- (ii) Office bearers of the council for a period of three years w. e. f. April 1, 2016; and
- (iii) Three members of the Council for a period of three years w. e. f. April 01, 2016.

The returning officer Prof. M. M. Shikare reported that the following members are declared elected.

President for 2016-17: Prof. D. V. Pai, IIT, Gandhinagar (Gujrat) is elected as the President of IMS for a period of one year with effect from April 01, 2016.

Office Bearers: The following mathematicians are elected as office bearers of IMS for the next three years w. e. f. April 1, 2016.

- (a) General Secretary: Prof. N. K. Thakare
- (b) Academic Secretary: Prof. Piyush Chandra
- (c) Treasurer: Prof. S. K. Nimbhorkar
- (d) Editor, JIMS: Prof. Satya Deo
- (e) Editor, The Math Student: Prof. J. R. Patadia

Members of the Council:

Dr. S. P. Tiwari (Indian School of Mines, Dhanbad) and Prof. P. Veeramani (IIT, Chennai) are elected as Members of the Council of IMS for a period of three years w. e. f. April 1, 2016.

Item No. 10: Any other item with the permission of the chair.

The Meeting ended with a vote of thanks to the President of IMS, the members present and the local organizers of the conference.

N. K. Thakare
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 N. K. Thakare, the General Secretary of the Indian Mathematical Society up to June 30, 2016. His e-mail address is nkthakare@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 provides a token support of Rs. 1000/- to a number of Departments / Institutions for organizing popular and semi technical lectures.

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. N. K. Thakare 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

Subscriptions

Annual subscription for the Journal / the Mathematics Student :

For each periodical

- Rs. 1500/- for Libraries of Educational Institutions in India - provided the subscription is direct or through an agent who gives complete name and address of the subscriber. The supply will be made directly to the subscribing library. If an agent subscribes for an educational Institution in India, the subscription is Rs. 1800
- Rs. 8000/- for others for personal use or to the agents who do not supply the name and address of the end user.
- \$150/- for personal use or for Libraries outside India.

The agents are entitled to 15 % discount on their orders.

From the 2012 issue of *The Mathematics Student* onwards, the life Members are given online access to *The Mathematics Student* / are sent the soft copy of *The Mathematics Student*, instead of supplying the hard copy, for their personal use (not for circulation) at their E-mail address registered with the Society.

Those Members who have not registered their e-mail address are requested to register it online on msgoesgreen@gmail.com

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.

Membership of the Society

Life Membership Fees:

Rs. 2000/- (US \$500/- for those residing outside India - referred to as *International Life Members*).

The Life Members of the Indian Mathematical Society who have registered their e-mail with the Society are entitled to a **FREE online access to *The Mathematics Student*** for their personal use (not for circulation). They can subscribe the Journal at Rs. 1500/- (US \$ 35/-) for their personal use (not for sale/resale).

Ordinary Annual Membership Fees:

Rs. 250/- (US \$50/- for those residing outside India).

Sessional Membership Fees:

Rs. 250/- (US \$50/- for those residing outside India). Sessional Members are those who join the Society only for a particular Session. They may contribute papers for presentation and / or participate in any of the academic programmes held during the Session.

- *Membership form is available on the IMS website.*

Business Correspondence and Payments:

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.

Members in good standing:

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

Each year, 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.

Notwithstanding 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.

(B) An offer of a donation of any amount in general, without any stipulated conditions, may be accepted by the Council on its merit as a part of the General Purpose Corpus.

The Council reserves its right whether or not a particular donation be accepted.

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**.

N. K. Thakare, General Secretary, IMS
c/o Department of Mathematics,
Savitribai Phule Pune University,
Pune-411007 (M.S.)
March 25, 2015.

Abstracts received for the 81st IMS Conference held at VNIT, Nagpur

Abstract of the Plenary Talk

Complete intersection points on affine varieties and 0-cycles, by

V. Srinivas TIFR, Mumbai.

After giving some background, I will discuss the problem of characterizing affine algebraic varieties all of whose smooth points are complete intersections. This problem has relations with algebra, geometry and number theory, through the theory of algebraic cycles, and in particular, the group of 0-cycles modulo rational equivalence.

Abstracts of the Memorial Award Lectures

(1) Evolution and asymptotic behavior of nonlinear hyperbolic waves by

V.D. Sharma and B. V. Rajarama Bhat, IIT Bombay, Mumbai.

Wave motions influenced by nonlinear convection, attenuation (on account of relaxation), dispersion, and geometrical spreading are the main focus of this lecture. Particular attention is focused on small amplitude disturbances including weak shocks and their asymptotic decay laws. In case the Laxs genuine nonlinearity parameter is small, a different scaling of the fast variable leads to transport equations exhibiting mixed nonlinearity; indeed, the transport equations exhibit both quadratic and cubic nonlinearities leading to shocks which are such that on one side the characteristics flow into them, while on the other side the characteristics may be parallel to them. The analysis of hyperbolic systems with diffusion and dispersion leads to an evolution equation with quadratic and cubic nonlinearities in the flux function. Riemann problem with a non-convex flux is much more involved; it arises in a large number of physical situations such as suspension of particles in fluids, nonlinear acoustics in real gases, and in oil reservoir simulations. Indeed, the non convexity of the flux function introduces a number of new phenomena such as non classical shocks, one sided shocks (also referred to as sonic shocks), and precursor waves; and we need more general admissibility conditions.

(2) Twisted conjugacy in groups of PL-homeomorphisms of the reals, by

Parameswaran Sankaran, Institute of Mathematical Sciences, CIT Campus, Taramani, Chennai.

The group of all piecewise linear homeomorphisms of the real line contains some very interesting classes of groups which have been extensively studied. These include the Richard Thompson group F and its generalizations. After a brief survey on these groups, I will report on some recent developments, based on joint work with D. L. Gonsalves and R. Strebel, concerning the existence of a non-zero character on one of these groups, which is left invariant by every automorphism of the group.

(3) Likelihood, Estimating Functions and Generalized Method of Moments, by Uttara V. Naik Nimbalkar, SPPU and IISER, Pune.

We begin with the likelihood theory, a central topic in statistical modeling and inference, attributed to Fisher (1922). Next we discuss the Estimating Function (EF) theory introduced by Godambe (1960) and Durbin (1960) in order to overcome the limitations of the assumption of the likelihood while modeling a random phenomenon, and then the Generalized Method of Moments (GMM) established by Hansen (1982) for applications in econometrics and for which he got, in part, the 2013 Nobel prize in economics. The EF theory combines the strengths of the Least Squares approach of Legendre (1805) and Gauss (1809, 1823) and the likelihood approach. We will end with a brief discussion of our work on the EF method for “state-space models” and for Hilbert space valued parameters.

(4) Generating matrix groups over nice rings, by B. Sury, Stat-Math Unit, Indian Statistical Institute, Bangalore.

Groups of matrices are ubiquitous in mathematics. Depending on the focus, the applications are to different subject like: (i) Lie groups or algebraic groups (if one works over infinite fields like the real or complex numbers, (ii) arithmetic groups (if one works over integers and other number rings, (iii) Classification of finite simple groups if one works over finite fields, and (iv) Representation theory - if one works over any ring.

Decompositions/factorizations into special types of pieces - Iwasawa, Cartan, Bruhat, Langlands, . . . - play crucial roles. Put another way, generating matrix groups via special kinds of elements is useful; for instance, generation by means of elementary matrices and studying relations between the generators is the subject of algebraic K-theory. We discuss two types of (related) questions here: (i) generating by means of abstract subgroups like cyclic groups and implications on the structure of the ambient group; (ii) 'finite width' factorization into unipotent subgroups over rings. In the talk, we will try to give brief survey of this area.

(5) Compact operators and Hilbert scales in ill-posed problems, by M. Thamban Nair, Department of Matheamtics, IIT Madras, Chennai,
E-mail: mtanair@iitm.ac.in

A Hilbert scale is a family of Hilbert spaces H_s , $s \in \mathbb{R}$ such that for every $s, t \in \mathbb{R}$ with $s < t$, $H_t \subseteq H_s$ and the inclusion operator is continuous. Given a Hilbert space, we show how to construct a Hilbert scale with $H_0 = H$ using the concept of Gelfand triple and give examples of Hilbert scales which are generated by compact operators between Hilbert spaces as well as closed densely defined unbounded operators. Citing results from some of the recent work of the author, we discuss the use of Hilbert scales while deriving error estimates for illposed operator equations.

Abstracts of the Invited Talks

(1) On almost Moore digraphs, by Edy Tri Baskoro, Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung, Jl. Ganesa No 10, Bandung 40132, Indonesia. E-mail: ebaskoro@math.itb.ac.id

For any integers $d, k \geq 1$, an almost Moore digraph, denoted by (d, k) -digraph, is defined as a diregular digraph of degree $d \geq 2$, diameter $k \geq 2$ and order $d + d^2 + \dots + d^k$, one less than the Moore bound. In this (d, k) -digraph, for every vertex u there is exactly one vertex v such that there are two walks of length $\leq k$ from u to v . The vertex v is called the repeat of u , denoted by $r(u) = v$. In case $r(u) = u$, vertex u is called a selfrepeat (the two walks, in this case, have lengths 0 and k).

The study of the existence of an almost Moore digraphs of degree d and diameter k has received much attention. Fiol, Alegre and Yebra (1983) proved the existence of $(d, 2)$ -digraphs for all $d \geq 2$. In particular, for degree $d = 2$ and diameter $k = 2$, Miller and Fris (1988) characterised all the $(2, 2)$ -digraphs. Gimbert (2001) showed the uniqueness of a $(d, 2)$ -digraph, namely the line digraph $L(K_{d+1})$ of the complete digraph K_{d+1} , for $d \geq 3$. However for degree 2 and diameter $k \geq 3$, it is known that a $(2, k)$ -digraph does not exist (Miller and Fris, 1992). Furthermore, there is no $(3, k)$ -digraph with diameter $k \geq 3$ (Baskoro, Miller, Siran and Sutton, 2005). Thus, the remaining case still open is the existence of (d, k) -digraphs with $d \geq 4$ and $k \geq 3$.

Several necessary conditions for the existence of (d, k) -digraphs, for $d \geq 4$ and $k \geq 3$, have been obtained. In this talk, we shall discuss some necessary conditions for these (d, k) -digraphs. Open problems related to this study are also presented.

(2) A glimpse of some graph dynamical systems, by Yaokun Wu, Shanghai Jiao Tong University, Shanghai, China.

Given a set S and a set F of maps from S to itself, the iterations of those maps in F produce a discrete dynamical system. The phase space of this dynamical system has S as its vertex set and there is an arc leading from u to v whenever there is a map from F sending u to v . We display several examples for which we can relate the local mechanism represented by F and the global behavior of the phase space.

(3) A Membership test for the classical groups, by Anupam Kumar Singh, Department of Mathematics, IISER, Pune.

One of the key problem in computational group theory is "Group recognition project". Membership test is a part of this project. Several algorithms have been developed and implemented in MAGMA and GAP. In joint work with my colleague Ayan Mahalanobis and my student Sushil Bhunia we have developed an alternate algorithm.

(4) Amartya Sen's mathematical approach to social choice theory, by B. N. Waphare, SPPU, Pune.

Arrow investigated the problem of finding an ideal method that collectively aggregates the preferences of finitely many individuals in a society into one joint decision in a rational manner. He defined a Social Welfare Function (SWF) as a function that maps each profile (n-tuple) of these individual preference orders into a unique social preference order.

Voting procedures in elections is one such example of an SWF. One of the most common voting methods is the majority rule, in which an alternative is taken to be socially better than another if the majority of individuals in the society prefer that alternative over the other.

In View of the Nobel Prize winner Amartya Sen, A study of different relations between individual preferences and social choice is one of our chief concerns. Varieties here are enormous. For example, someone might take the view, implicitly or explicitly, that only his aspirations should count in social choice. Or only the homogeneous interests of a particular class, or a group. Or one might argue that everyones preference "should count equally", but that statement itself can be interpreted, as we shall presently see, in many different ways and corresponding to each interpretation we get a different system of making collective choice. In this lecture we elaborate these systems, their nature, their operations, and their implications using algebraic operations.

(5) Some generalized thermoelastic problems with heat supply in a solid cylinder, by K.C. Deshmukh, R.T.M. Nagpur University, Nagpur-440033.

The continuous and discontinuous analysis of the temperature, displacement and stress fields in a thick plate whose lower and upper surfaces are traction free and subjected to a given axisymmetric temperature distribution and an internal heat generation within the solid is considered and discuss the generalized thermoelastic behavior in context with Lord-Shulman, Green-Lindsay and Classical coupled theories. Integral transform technique is developed to determine the solutions and results are illustrated numerically for copper material.

(6) Retractable and related modules, by A. K. Chaturvedi, Department of Mathematics, University of Allahabad, Allahabad-211002, India.
akc99@rediffmail.com, akchaturvedi.math@gmail.com

In 1979, Khuri introduced the concept of retractable modules. An R -module M is said to be retractable if $\text{Hom}(M; N) \neq 0$ for all non- zero submodules N of M . In

2005, Smith called such modules slightly compressible. The classes of modules related to this notion were studied by various authors and a rich theory was developed. Here, we discuss some recent developments in the notion of retractable modules that is we see the kind of relations of modules with their non zero submodules. We restrict our discussion with the classes of modules compressible, epi-retractable and iso-retractable modules. We highlight general properties of them. Also, we discuss properties of these modules over V -ring, Noetherian ring, hereditary ring, regular ring etc. We study Morita invariant property of them. We see characterization of various rings and modules related to these classes. Smith call an R -module Mcompressible if, for every non-zero submodule N of M , there exists a monomorphism from M to N . In 2009, Ghorbani et al. called an R -module M epi-retractable if every submodule of M_R is a homomorphic image of M . In 2012, Pandeya et al. and in 2013, Mostafanasab studied some applications of epi-retractable modules. In 1984, Tiwari et. al. studied the class of absolutely elastic modules. They call an R -module M absolutely elastic if every nonzero submodule of M is isomorphic to M . In 2014, we called such modules iso-retractable and studied various new properties of it.

(7) Moduli of quiver representations and its applications by Sanjay Amrutiya, IIT, Gandhinagar.

This talk focuses on the geometric approach to study the representations of quivers and its applications. A. King introduced the concept of moduli of representations of quivers. These concepts are quite useful in algebraic geometry. In this talk, we will briefly study the King's construction of moduli of quiver representations and its application to moduli of (equivariant) sheaves on projective scheme defined over an algebraically closed field of arbitrary characteristic.

(8) Low Reynolds number flow in tubes of varying cross-section by J.S.V.R. Krishnaprasad, M. J. College, Jalgaon.

In recent years, the study of viscous flow in tubes of varying cross-section has attracted many researchers due to its relevance in physiological and engineering flow problems. In particular, such studies play a significant role in understanding the flow in arteriosclerotic blood vessels. Most of these studies have considered the tube walls to be impermeable. However, it has been pointed out that the early atheroma is associated with the low permeability of the blood vessel wall. Thus, permeability becomes an important factor which needs to be considered in such studies. On the other hand, Flow through tubes of uniform radius and permeable walls has been extensively investigated because of its applications in many engineering flow problems. An introduction to the combination of above two research topics is proposed in this lecture. A mathematical formulation for steady and unsteady flow through tubes of varying cross section with permeable walls has been formulated and a semi analytical approach to solve the problem by perturbation methods is explained. The impact of various flow characteristics is discussed with the help of graphs.

(9) Interconnection network-A special reference to perfect difference network by Rakesh Katare, Department of Computer Science, APS University, Rewa. Perfect difference network are depend on the mathematical notion of perfect difference set. It constitute high performance interconnection networks for parallel and distributed system. Here we discussed some basic properties of PDN.

(10) Design of intelligent scalable learning algorithms for handling Big Data in soft-computing frameworks by Aruna Tiwari, Computer Science and Engineering, Indian Institute of Technology, Indore

The development and maturity of the information technologies has enabled an

exponential growth on the data that is produced, processed, stored, shared, analyzed and visualized. Big data encompass a collection of datasets whose size and complexity challenges the standard database management systems and defines the application of knowledge extraction techniques. This data comes from a wide range of sources such as sensors, digital pictures and videos, purchase transactions, social media posts, everywhere. This generation and collection of large datasets has further encouraged the analysis and knowledge extraction process with the belief that with more data available, the information that could be derived from it will be more precise. However, the standard algorithms that are used in data mining, soft computing are not usually able to deal with these huge datasets. Therefore, the need for developing intelligent scalable algorithms has been realized with the ability to perform classification, clustering and feature selection in optimal sense after adjusting their parameters in an adaptive way to accomplish faster solutions to address Big Data.

(11) Verb morphology and demand frame generator Hindi and Marathi languages by Ramchandra P. Bhavsar, School of Computer Science, North Maharashtra University, Jalgaon.

Considering the overall linguistic character (rich morphology, free-word-orderness, use of post position markers etc.) of Indian Languages, it is acclaimed that the Paninian tradition (500 B.C.) of sentence analysis is the most feasible option for doing NLP applications for Indian Languages in which NL parsing is must. Verb is at the center stage in Paninian analysis. Verb specify its argument requirements (Aakanksha) in the form of demand frame also referred as verb frame. This demand frame is associated with each verb form. Considering the number of verb forms, the verb morphology generation process is mechanical and cumbersome. Hence we have developed a computational framework for generating verb morphology and demand frames for finite verbs (stems) of Hindi and Marathi.

Paninian analysis treats sentence as a sequence of noun groups and verb group 1. Relation between noun and verb is called as Karaka relation (or simply Karaka). Primarily, eight Karakas have been specified viz. karta (subject), karma (object), karan (instrument), sampradan (dative object), adhikaran (locative), apadaan (ablative), sambandhvachak (relative) 2, and sambodhan (vocative). Karakas are syntactico-semantic in nature (Akshar Bharati et. al. 2000). What it means is that Karakas denote semantic role which is identified using syntactic cue i.e. post position marker symbol 3 . These Karakas are associated with verb. All Karakas collectively specify verbs demand frame. We can think of demand frame as single monolithic structure having seven (excluding sambandhvachak) compartments, where each compartment has two slots one denoting the Noun specification (syntactic and semantic features) and other denoting the post position marker symbol. As stated in above section, verb plays important role in Paninian analysis because parsing process is designed around demand frame. In simple words, parsing sentence in Paninian framework is about satisfying the Karaka constraints specified in demand frame and nomination of Karaka roles. This fact underlines the importance of verb demand frame resource. Every verb form (morphological inflection) has a demand frame is associated with it. Hence while designing this tool; we have to consider these two aspects i.e. demand frame and verb morphology together.

The generation process takes place in two phases. First is creation of data and second is generation of demand frames. Data creation activity captures two kinds of data i.e. Master Data and Root Verb data. Master Data includes data such as morphology transformation rules, and Vibhkti frame data. This data is created by linguist. The rule specification caters for relevant information necessary for generating the inflected form. The other data is semantic frame of stem verb, whose

morphology and demand frame is to be generated. This data may be entered by linguist or non-linguist.

The second phase actually generates the verb morphology for chosen verb stem. Rule applicator picks and applies the appropriate rules matching with input verbs attributes and rule application criterion specified in the rule. It then generates verb form and demand frame which is presented to the user on tools UI for choosing correct forms and saving them to Verb lexicon database. After painstaking efforts, we have formulated exhaustive morphology generation rules for Hindi and Marathi (Table 1).

Morphology Rules Hindi Marathi Inflectional 3,708 2,660 Morphology Rules Table 1: Morphology Rule Data summary

The framework was tested on sample verbs of Hindi and Marathi chosen from different verb classes (Intransitive, Transitive, Di-Transitive). Precision measure was used to evaluate performance of the system (Table 2).

Language Data Size Precision Hindi 24 96.47 Marathi 23 82.31 Table 2: Result Analysis

Followings are the features of our tool:

Our tool generates both verb morphology as well as verbs demand frame under one hood.

The data is encoded using UNICODE.

Design is generic so that it can be extended to other Indian Languages also.

The resource created through this tool can be used for both parsing and Machine Translation application. Besides these, this framework can also be used to generate Treebank for Hindi and Marathi as well as for automatic corpus creation, grammar checker etc.

The automation achieved through this tool can save money and labor required otherwise to generate this resource.

UI design of various forms in the tool is quite intuitive and user friendly.

(12) Big Data analysis in the issues of social media content by Nishchol Mishra, School of Information Technology, Rajiv Gandhi Proudयोगiki Vishwavidyalaya, Bhopal-462033, nishchol@rgtu.net

Everyday enormous amount of data is being produced worldwide Big Data analytics has brought a big opportunity for organizations. Companies capture trillions of bytes of information about their customers, suppliers, and operations. IT organizations are exploring the analytics technologies to explore web-based data sources and extract value from the social networking boom. The organizations are trying to leverage Big Data by trying to make sense from the data that they have and by securing it.

(13) Introduction to Big Data and Hadoop technology by Mahesh Pawar, Department of Information and Technology, UIT, RGPV, Bhopal.

In this talk we cover the architecture of Hadoop 1.0 and 2.0 and various tools like flume, sqoop etc.

(14) Future Research and Business Trends in Cloud Computing by Rajeev Wankar, School of Computer and Information Sciences, University of Hyderabad, Hyderabad, India.

In the last decade Cloud Computing emerged as one of the most popular distributed Computing technologies, providing various types of services to its customers through INTERNET. The famous five essential characteristics makes it more superior, flexible, and amenable to implement in a real environment. Gartner Inc. also predicted its enormous growth in past years. Roughly Eight years back clouds entered the enterprise IT, introduced by public providers such as Amazon,

Google, and Salesforce.com and via private stacks from VMware, Microsoft, and Citrix. We're now much more aware of the limitations and consequences of this utility computing. In this talk we will raise certain issues and suggest the future research and business trends.

Abstracts of the lectures delivered in symposia

(1) Symposium on Recent Advances in Complex Analysis

(i) Advances in complex dynamics by Anand P. Singh, Central University of Rajasthan, Bansarsindri, Kishangar -305817, (Rajasthan).

Complex dynamics deals with the properties associated with the iteration of analytic functions. Let $f : \mathbb{C} \rightarrow \hat{\mathbb{C}}$ be a meromorphic function. We define $f^0(z) = z$, $f^n(z) = f(f^{n-1}(z))$, $n = 1, 2, \dots$. A family F , of meromorphic functions in a domain $D \subseteq \hat{\mathbb{C}}$ is said to be normal family if every sequence f_n in F contains a subsequence that converges uniformly on compact subsets of D . The set $\mathcal{F} = \{z \in \hat{\mathbb{C}} : f^n, n \in \mathbb{N} \text{ is defined and normal in some neighborhood of } z\}$, is called the Fatou set or the set of normality and its complement $\hat{\mathbb{C}} \setminus \mathcal{F}$ denoted by \mathcal{I} is called the Julia set. Various properties of these two complementary domains of the complex sphere have been studied. Fatou and subsequently Eremenko observed that the points that escape to infinity also play an important role in complex dynamics. Eremenko later defined the escaping set. For a transcendental entire function f , he defined the escaping set as: $I(f) = \{z \in \mathbb{C} : f^n(z) \rightarrow \infty \text{ as } n \rightarrow \infty\}$ and proved that $I(f) \cap \mathcal{I}(f) \neq \emptyset$, $\partial I(f) = \mathcal{I}(f)$ and all the components of $I(f)$ are unbounded. He further conjectured that all the components of $I(f)$ are unbounded. This has led to a rich development in the field. Some partial results in confirmation of this conjecture have been obtained. In our talk we plan to give some recent developments in this emerging field of complex dynamics, viz., the escaping sets of entire functions.

(ii) Nevanlinna's five and four value theorems and allied results by I. Lahiri, Kalyani University, Kalyani, West Bengal.

The five and four value theorems of the Finnish mathematician Prof. Rolf Nevanlinna are two outstanding results in the history of Complex Analysis. In fact, these are the two theorems which initiated the modern theory of uniqueness of meromorphic functions. In the talk we discuss the five and four value theorems and the course of research motivated by these results.

(iii) Radius problems in the theory of harmonic univalent mappings in the complex plane, by Om Ahuja, Kent State University, Ohio, U.S.A. oahuja@kent.edu

Harmonic univalent mappings have attracted the serious attention of complex analysts only recently after the appearance of a basic paper by Clunie and Sheil-Small in 1984. These researchers laid the foundation for the study of harmonic univalent mappings over the unit disk as a generalization of analytic univalent functions.

It has been of interest to determine the largest subdisk $|z| < \rho < 1$ in which a complex-valued, analytic, and normalized functions f of the form $f(z) = z + \sum_{n=2}^{\infty} a_n z^n$ defined in the open unit disk D satisfying the inequality $a_n \leq n$ for $n \geq 2$ are univalent. Motivated by this problem, various radius problems associated with analytic as well as harmonic mappings for several classes of functions have been studied. The purpose of this talk is to provide radius problems in the theory of planar harmonic univalent mappings with emphasis on recent results and open problems. In particular, the presentation will also highlight some of the speakers recent work on radius problems.

(2) Symposium on Fractional Calculus: Current Trends

(i) **Fractional calculus in the matrix-variate case**, A. M. Mathai, Center for Mathematical and Statistical Sciences, Peechi, Kerala, McGill University, Montreal, Canada.

Functions of matrix argument are real-valued scalar functions where the argument is a matrix, usually real positive definite or Hermitian positive definite. Starting from 2007 this author has been developing fractional calculus (fractional integrals and fractional derivatives) for matrix-variate cases in the real and complex domains. Also, a connection of fractional calculus to matrix-variate statistical distributions is also established. Fractional integrals are developed more or less for all situations corresponding to real scalar variable cases but the matrix differential operator developed is suitable only for certain types of scalar functions of matrix argument. Thus a universal matrix differential operator is an open problem here. Also this author has developed fractional integrals for functions of several matrix arguments. Here also, a general structure is still an open problem. Some of these aspects will be described in this talk.

(ii) **Fractional differential Equations: A review** by Varsha Daftardar-Gejji, Savitribai Phule Pune University, Pune-411007.

Analysis and applications of fractional differential equations (FDEs) have currently been an active area of research owing to their applicability to a variety of problems in Science and Engineering. Fractional order derivatives provide a novel approach for modelling the dynamics of many phenomena. We take a review of recent developments in the field of FDEs, pertaining to their analysis and numerical methods. We discuss developments in the theory of dynamical systems of fractional order and related phenomena such as chaos. Further we explore some applications of FDEs.

(iii) **Local fractional differential equations**, by Kiran Kolwankar, Department of Physics, Jhunjhunwala College, Mumbai.

Local version of the fractional derivative helps us to characterise the local scaling behaviour of functions and fractals are sets involving non trivial local scaling. As a result, the local fractional derivative turns out to be a natural tool to handle fractal structures and processes. The next step is to consider equations involving the local fractional derivative. Such equations help us to incorporate fractal set naturally into equations. The developments and problems in this line of thought will be reviewed.

(iv) **Analysis of fractional order delay differential equations** Sachin B. Bhalekar, Shivaaji University, Kolhapur.

Fractional order delay differential equations are the dynamical systems involving arbitrary order derivative and a delay term. In this lecture, we discuss the stability result for a class of such systems. Further, we analyze the fractional order version of Mackey-Glass equation using the proposed results.

(3) Symposium on Global Differential Geometry

(i) **Ricci solitons and its applications to contact geometry** by Arindam Bhattacharyya, Jadavpur University, Kolkata-700032, bhattachar1968@yahoo.co.in Ricci solitons' are self similar solution of Ricci flow, introduced by Richard Hamilton in the year 1982 to prove Thurston's geometrization conjecture in a paper published in J. Differential geom. 17(1982), 255-306. Ricci solitons can occur without the assumption that M is compact which was necessary for Ricci flow. The solution of Ricci flow equation $\frac{\partial g(t)}{\partial t} = -2s$ (1)
 $g(t)$ is rescaled by $\hat{g}(t) = \sigma(t) \psi_t^*(g(t))$, where ψ_t^* is the pull back function of $g(t)$

and $\sigma(t) = 12\lambda(t)$, where $\lambda \in \mathbb{R}$, takes the form $Ricg_0 = S$ i.e. $\mathcal{L}_X g + 2S + 2\lambda g = 0$. When $\lambda = 0$ the soliton is steady, if $\lambda < 0$ the soliton is shrinking and for $\lambda > 0$ the soliton is expanding. J. T. Cho and R. Sharma proved that a compact contact Ricci soliton with a potential vector field V collinear with the Reeb vector field is Einstein. The concept of gradient Ricci soliton has been also developed where the vector field X of Ricci soliton can be written as the gradient of some function $f : M \rightarrow \mathbb{R}$. In this case $\mathcal{L}_X g = 2Hessf = 2\nabla\nabla f$. Thus the gradient Ricci soliton equation takes the form $\nabla\nabla f + S = \lambda g$. X. Cao has done some interesting works on gradient Ricci soliton in a paper published in *J. Geom. Anal.* 17(2007),425-433. The concept of Ricci almost soliton was first introduced by S. Pigola, M. Rigoli, M. Rimoldi, A. G. Setti in 2010. Later R. Sharma has done an excellent work and named as almost Ricci soliton. Here λ is considered as a function from M to \mathbb{R} , instead of constant. In 2004, conformal Ricci flow was introduced by A. E. Fischer in *Class. Quantum Grav.* 21 s 171-s 218, where the conformal pressure p takes an important role and the flow resembles with the flow of fluid mechanics. The equation of conformal Ricci flow is given by $\frac{\partial g}{\partial t} + 2(S + \frac{g}{n}) = pg$ and $rg = 1$, where p is a non-dynamical time dependent scalar field. This is a variation from the classical Ricci flow equation that modifies the unit volume constraint of the equation to a scalar curvature constraint. In this connection we have developed conformal Ricci soliton, conformal gradient Ricci soliton and almost conformal Ricci soliton. So in this presentation we shall discuss about Ricci solitons and gradient Ricci solitons in LP - Sasakian manifold, conformal Ricci soliton on Lorentzian α Sasakian manifold and on 3-dimensional *trans*-Sasakian manifold, conformal gradient Ricci soliton on 3-dimensional *trans*-Sasakian manifold, some curvature identities on almost conformal gradient shrinking Ricci soliton and almost conformal Ricci soliton on 3-dimensional *trans*-Sasakian manifold.

(ii) Lightlike submanifolds of semi-Riemannian manifolds by Rakesh Kumar, Department of Basic and Applied Sciences, Punjabi University, Patiala, Punjab.

Due to significant applications of geometry of lightlike submanifolds in mathematical physics and has potential for further research therefore research on this subject matter becomes the topic of present scenario. In this talk we shall discuss lightlike submanifolds of semiRiemannian manifolds and their induced geometric objects. Since the induced objects on a lightlike submanifold depend on its screen distribution which, in general, is not unique and hence we can not use the classical submanifold theory on a lightlike submanifold in the usual way. Therefore we shall discuss screen conformal lightlike submanifolds of a semiRiemannian manifold, which are essential for the existence of unique screen distribution. We will conclude the talk with the discussion of symmetry of the induced Ricci tensor and vanishing of the null sectional curvature.

(iii) Finsler manifolds of constant positive curvature by H. G. Nagaraja, Bangalore University, Bangalore.

One of the important problems in Finsler geometry is to study and characterize Finsler metrics of constant flag curvature. In this talk, we discuss the classification problem on Finsler metrics of constant flag curvature. Finsler metrics of constant flag curvature are classified as projective and non-projective Finsler metrics. Both these classes contain zero, negative and positive constant flag curvature. Many of these metrics are in the form $F = \alpha + \beta$, where α is a Riemannian metric and β is a 1-form. We discuss the conditions for these metrics to be of constant flag curvature.

(iv) Symplectic geometry and its applications to differential Equations by N. Uday Kiran, Department of Mathematics and Computer Science, Sri Sathya Sai Institute of Higher Learning, Prashanthi Nilayam, Puttaparthi, Andhra Pradesh-515134

In this short talk, we will provide a popular introduction to Symplectic geometry. The Symplectic manifolds have their origin in the Hamiltonian formulation of classical mechanics of certain classical systems. After covering basic Symplectic geometry we compare these geometries with Kähler and Almost Complex geometries. At the end of the talk, a brief application to the phase space metrics and pseudo-differential operators will also be mentioned.

(v) Chen-Ricci inequalities for curvature like tensors and their applications by Mukut Mani Tripathi, BHU, Varanasi 221 005. mmtripathi66@yahoo.com Since the celebrated theory of J. F. Nash of isometric immersion of a Riemannian manifold into a suitable Euclidean space gives very important and effective motivation to view each Riemannian manifold as a submanifold in a Euclidean space, the problem of discovering simple sharp relationships between intrinsic and extrinsic invariants of a Riemannian submanifold becomes one of the most fundamental problems in submanifold theory. The main extrinsic invariant is the squared mean curvature and the main intrinsic invariants include the classical curvature invariants namely the Ricci curvature and the scalar curvature. There are also many other important modern intrinsic invariants of (sub) manifolds introduced by B.-Y. Chen.

(4) Symposium on Algorithmics and Graph Theory

(i) Model checking algorithms-theory meets practice by Bharat Adsul, IIT Bombay, Mumbai.

Model checking algorithms address the practical problem of automatically verifying if a finite-state program meets a given specification. At the heart of these algorithms are simple yet delicate connections between formal logic and automata. In this talk, we will explore some of these theoretical connections and the roles they play in the design of the model checking algorithms.

(ii) Decremental all-pairs ALL shortest paths, by Meghana Nasre, IIT Madras, Chennai.

Given a directed positive edge weighted graph G , we consider the all-pairs ALL shortest paths (APASP) problem, which maintains the shortest path dag rooted at every vertex in G . In the traditional dynamic all-pairs shortest paths problem one is interested in maintaining the distance matrix and possibly one shortest path between every pair of vertices. For this problem Demetrescu and Italiano [1] gave an efficient algorithm which relies on the novel concept of locally shortest paths. However, this result does not immediately give an efficient algorithm for the more general problem of all-pairs ALL shortest paths.

In this talk, we first present the notion of locally shortest paths, their useful properties, and then generalize them to locally shortest path tuples. These tuples form the basis for our decremental all-pairs ALL shortest paths algorithm. We also briefly discuss the application to betweenness centrality, a measure that is widely used for analysis of large complex networks. This is joint work with Matteo Pontecorvi and Vijaya Ramachandran and has been published at ISAAC 2014.

(iii) Randomization and recent advances in sampling techniques for data mining, by Vinayak D. Pandit, IBM India Research laboratory, Bengaluru.

This talk will focus on highlighting the power, simplicity, and beauty of randomization in designing algorithms. In the first half, we will cover these aspects by

reviewing some of the classic uses of randomization. In the second half, we will focus on sampling for data mining problems. Although sampling was used in practice for a long time for data mining problems, a framework to analyze the quality of the solutions obtained by sampling was missing. Some of the recent works, including that of the authors, have presented a framework to study the quality of the solutions provided by sampling and the bounds on the sample sizes required for guaranteeing certain accuracy constraints. We will present the frameworks, sampling techniques, and derive the bounds on sampling sizes required for satisfying accuracy constraints.

(5) Symposium on Cryptography and Security

(i) Ciphering to provide secure communication on GSM by Geetam Tomar, Director, Machine Intelligence Research Lab, Gwalior.

In present era of technological advancements in wireless communication and demand of abrupt services ubiquitously, the GSM has become trusted solution. With its great features like providing access to users at anytime and anywhere in the world, it has been very attractive among the users as well as operators and service providers. However, despite of all such advantages, the major concern it has been facing is security problems. In 2G and 3G there are mainly three components; the mobile station (MS), Visitor Location Register/Serving GPRS Support Node (VLR/SGSN), and Home Location Register /Authentication Center (HLR/AuC). To provide security services like authentication and secure communication, some mechanisms have been adopted using asymmetric cryptography and some ciphering techniques to provide trustworthy communication. In this talk the ciphering procedures and encryption mechanisms will be discussed in detail with relevant modular description and flow graphs. The security at various levels like MS, network, switching and media will also be part of discussion.

(ii) Bitcoins-Under the hood, by Chester Rebeiro, IIT, Chennai.

Bitcoin is a form of currency that was introduced in 2009 for e-commerce applications. Unlike traditional currencies, bitcoins does not need a centralized bank or administrative institution. It relies on cryptography and a peer-to-peer network in order to achieve trust and to maintain ledgers. In last five years bitcoins has been legalized in a number of countries, and adopted as a payment mode in several online trading houses. In this talk we would discuss the architecture of bitcoin and understand how cryptography is used to achieve trust in spite of an untrusted environment.

(iii) Security techniques in cloud storage, by Ankur Panchbudhe, CTO, Vaultize, Pune.

The talk will present a few practical techniques being used by cloud companies and organizations to tackle various security aspects of cloud storage while being cost-effective. These techniques allow users of cloud storage to be secure, safe and compliant with various laws, regulations and standards. The talk will present techniques including global and centralized de-duplication, various forms of encryption like at-source encryption and storage encryption, convergent encryption and encryption gateways. At the end of this talk, the audience will be able to appreciate how cloud storage companies do some of their magic in an increasingly competitive and unsecure world.

(6) Symposium on Relativity

(i) The mathematical aspects of Einstein's general relativity by Subenoy Chakraborty, Jadavpur University, Kolkata.

In this talk we shall discuss how starting from equivalence principle ,the space-time geometry needs to be curved geometry and there is singularity of the space-time. Also we shall discuss the Schwarzschild solution in different co-ordinates and consequences geometrically and physically.

(ii) A critique of the historical development of general relativity: A centennial perspective, by Ram Gopal Vishwakarma, Unidad Acadmca de Matemáticas, Universidad Autnoma de Zacatecas C.P. 98068, Zacatecas, ZAC Mxico.

Einstein's theory of General Relativity (GR), wherein gravitation shows up through the curvature of spacetime, is undoubtedly one of the most beautiful theories in theoretical physics. The theory has made remarkable progress on both, theoretical and observational fronts during a century since its inception in 1915 and describes accurately all gravitational phenomena ranging from the solar system to the universe. However, there is a price for this success which is often ignored. More than 95 percent of the content of the universe has to be dark, in the form of dark matter and dark energy, which do not have any non-gravitational or laboratory evidence. Moreover, there are many other conceptual problems afflicting the theory which remain unanswered. From a critical review of the historical development of GR, a new insight with a deeper vision of a geometric theory of gravitation emerges, which lead us to believe that the development of GR was perhaps on a wrong track, though it had an elegant and profound conceptual foundation.

(iii) Transit anisotropic cosmological models of the universe and recent observations by Anirudh Pradhan, Institute of Applied Sciences and Humanities G. L. A. University, Mathura-281 406. E-mail: pradhan.anirudh@gmail.com

Motivated by the increasing evidence for the need of a geometry that resembles Bianchi morphology to explain the observed anisotropy in the WMAP data, we have discussed some features of the Bianchi type universes in the presence of a fluid that yields an anisotropic equation of state (EoS) parameter in general relativity. Such models are of great interest in cosmology in favour of constructing more realistic models than FLRW models with maximally symmetric spatial geometry. Additionally, the interest in such models was promoted in recent years due to the debate that was in progress on the analysis and the interpretation of the WMAP (Komatsu et al. 2009, 2011; Sperget et al. 2007) data, whether they need a Bianchi type morphology to be explained successfully (de Oliveira-Costa et al. 2004; Bennet et al. 2003, 2011; Hoftuft et al. 2009). The ILCWMAP data maps show seven axes well aligned with one another and the direction Virgo. For this reason Bianchi models are important in the study of anisotropies.

In the present study of Bianchi type-I, II, III, V and VI 0 space-times, we observe that the EoS for dark energy ω is found to be time-dependent and its existing range for derived models is in good agreement with the recent observations of SNe Ia data (Knop et al. in *Astrophys. J.* 598:102, 2003), SNe Ia data with CMBR anisotropy and galaxy clustering statistics (Tegmark et al. in *Astrophys. J.* 606: 702, 2004) and latest combination of cosmological datasets coming from CMB anisotropies, luminosity distances of high redshift type Ia supernovae and galaxy clustering (Hinchshaw et al. in *Astrophys. J. Suppl.* 180:225, 2009, Komatsu et al. in *Astrophys. J. Suppl.* 180:330, 2009). It has been suggested that the dark energy that explains the observed accelerating expansion of the universe may arise due to the contribution to the vacuum energy of the EoS in a time dependent background. The cosmological constant is found to be a positive decreasing function of time and it approaches to a small positive value at late time (i.e. the present epoch) which is corroborated by results from recent type Ia supernovae observations.

(iv) Bouncing cosmologies by R. Chaubey, DST-Centre for Interdisciplinary

Mathematical Sciences, Faculty of Science, BHU, Varanasi-221 005.

Many cosmological scenarios envisage either a bounce of the universe at early times, or a collapse locally to form a black-hole which re-expands into a new expanding universe region. Energy conditions preclude this phenomena for ordinary matter in general relativistic universe, but scalar or other types of fields can violate some of these conditions, and so can, possibly, provide conditions for a bouncing universe. In this talk, we will discuss the necessary conditions for a bounce in FRW, Kantowski-Sachs (KS) and Bianchi type models in some modified theories of gravity like Hoyle-Narlikar creation field theory, Lyra geometry, Brans-Dicke theory, general class of scalar-tensor theories, Einstein's theory with variable cosmological term and Finslerian Cosmology. We will derive the model-independent minimal necessary conditions for non-singular bounce and show that there is an open temporal region surrounding the bounce over which the strong energy condition (SEC) must be violated. Null energy conditions are also violated in some of the modified gravity theories.

(v) Current problems in general relativity and Cosmology: A brief review of present status by T. Singh, DST-Centre for Interdisciplinary Mathematical Sciences, Faculty of Science, BHU, Varanasi-221 005.

IMS Prizes

Group-1: Discrete Mathematics, Lattice Theory, Set Theory, Logic, Number Theory and related areas:

(i) On the number of real quadratic fields with class number divisible by a prime p by Azizul Hoque, Department of Mathematics, Gauhati University, Guwahati, Assam, India-781014.

In this paper, we find a new lower bound on the number of real quadratic fields whose absolute discriminant is $\leq x$ and whose class number is divisible by a prime $p \geq 5$. More precisely, for a prime number $p \equiv 1 \pmod{4}$, we establish under the truth of ABC conjecture that the number of real quadratic fields whose absolute discriminant is $\leq x$ and whose class number is divisible by p is $\gg x^{\frac{1}{p} + \frac{1}{p-1}}$. We also establish that for a prime number $p \equiv 3 \pmod{4}$, this bound is $\gg x^{\frac{1}{2} + \frac{1}{p}}$. In both the cases, we improve the existing best known lower bound obtained by G. Yu.

(ii) On Hamiltonian colorings of trees by Devsi D. Bantva, Lukhdirji Engineering College, Morbi 363642.

A Hamiltonian coloring of a graph G of order P is a mapping $c : V(G) \rightarrow \{0, 1, 2, \dots\}$ such that $D(u, v) + |c(u) - c(v)| \geq 1$, for every two distinct vertices u and v of G , where $D(u, v)$ denotes the detour distance between u and v which is the length of a longest u, v - path in G . The value $hc(c)$ of a Hamiltonian coloring c is the maximum color assigned to a vertex of G . The Hamiltonian chromatic number, denoted by $c(G)$, is the $\min \{hc(c)\}$ taken over all Hamiltonian coloring c of G . In this paper, we present a lower bound for the Hamiltonian chromatic number of trees and give a sufficient condition to achieve this lower bound. Using this condition we determine the Hamiltonian chromatic number of symmetric trees, firecracker trees and a special class of caterpillars.

Group-2: Algebraic Geometry, Geometry, Topology, Algebraic Topology and related areas:

(i) On mixed super quasi-Einstein warped products by Buddhadev Pal, University of Calcutta, Kolkata, pal.buddha@gmail.com

In this paper, we study mixed super quasi-Einstein warped product manifolds for arbitrary dimension $n \geq 3$ and we give an example of mixed super quasi-Einstein

manifold $(MS(QE)_n)$ to ensure the existence of such manifold. Also in the last section, we also give an example of warped product on mixed super quasi-Einstein manifold.

Ricci solitons on multiply warped product spaces and on Lorentzian - Kenmotsu manifold by Tamalika Dutta, Jadavpur University, Kolkata-700032, tamalika.math@hotmail.com

The object of the present paper is to study gradient Ricci soliton multiply warped product. We have proved that for Riemannian product, the potential function depends only on the base and for non-constant warping functions the fibers become Einstein manifolds. Next we have established the conditions for the existence of gradient Ricci soliton multiply warped product. We have also studied Lorentzian β -Kenmotsu manifold admitting Ricci soliton and conformal Ricci soliton satisfying some curvature conditions.

Group-3: Measure Theory, Probability Theory, Stochastic Processes, and related areas.

No abstract was received.

Group-4: Differential/Integral/Functional equations and inequalities, Special Functions, Numerical Analysis and related areas.

No abstract was received.

Group-5: Solid Mechanics, Fluid Mechanics, Electro-magnetic Theory, MagnetoHydrodynamics, Astronomy, Astrophysics, Relativity and related areas.

Dark energy models in $f(R, T)$ modify gravity with variable deceleration parameter. by Binaya K. Bishi, V. N. I. T., Nagpur-440010. binaybcgmail.com

This article deals with the Bianchi type-III dark energy model and equation of state parameter in a first class of $f(R, T)$ modify gravity. The exact solutions of the modified field equations are obtained by using (i) linear relation between expansion scalar and shear scalar (ii) linear relation between state parameter and skewness parameter and (iii) variable deceleration parameter. It is observed that our models are accelerating for $0 < n < 1$ and for $n > 1$, models show phase transition from deceleration to acceleration. Further, we have discussed physical properties of the models.

Group-6: Operations Research, Optimization, Computational Mathematics, Information Technology, Biomathematics, History of Mathematics and related areas. (i) Prices and order quantities of substitutable products in an EPQ model, by Rakesh L. Das, Sardar Vallabhbhai National Institute of Technology, Surat-395007. rakeshdas.svnit@gmail.com

In current scenario, big departmental stores used to work more efficiently with the items that can be substituted either with optimum order quantities or selling prices of the products. At times purchaser of one particular item transfers to relevant substitutable item because of difference in prices or the quantities that can be purchased in bulk. In this paper, the problem is determined in total profit maximization problem and solved through a gradient based search technique- GRG (Generalized Reduced Gradient) method. The prices and optimal order quantities of substitutable items are obtained so that total profit for store owner is maximum.

(ii) Role of information and limited treatment on the control of infectious diseases by Anuradha Yadav, IIT Patna, Bihta-801103. anuradha.2101@gmail.com
Infectious diseases are one of the major contributors of total deaths across the globe

and are also cause of economic burden in terms of treatment, health-care, opportunity loss etc. In this paper we consider a compartmental model where it is assumed that there is information about the disease in the population. This information is spread through awareness program via media, TV etc. or via advertisements by government bodies. Due to the presence of information, individuals take protective measures to avoid the interaction with infective. We also account for the treatment in the model provided to infective individuals. A threshold value is obtained and we observe that a disease free steady state exists and is stable for threshold value less than one and is unstable otherwise and in that case endemic steady state exists and is globally asymptotically stable for under certain condition. We perform numerical experimentation to discuss and describe the results obtained. We observe that information is helpful in lowering the prevalence but cannot help to eradicate the disease on its own.

AMU Prize: Algebra, Number Theory, Lattice Theory, Set Theory, Logic and related areas.

On Somos's theta-function identities of level 6 by Srivatsa Kumar B.R., Manipal Institute of Technology, Manipal University, Manipal- 576 104. brsriat-sakumar@gmail.com

M. Somos discovered many theta-function identities of different levels using computer and offered no proof for them. The purpose of this paper is to prove theta-function identities of level 6.

V M Shah Prize: Real Analysis, Complex Analysis, Functional Analysis, Harmonic Analysis, Approximation Theory, Special functions and related areas.

(i) On new fixed point results for F-multiplicative Banach contraction mappings in the framework of multiplicative metric spaces by Dilip Jain, Sardar Vallabhnbhai National Institute of Technology, Surat. dilip18pri@gmail.com
We have introduced the concept of F-multiplicative Banach contraction mapping in the sense of a multiplicative metric spaces and establish some fixed point results for such mappings. We also give some examples which support our main result while previous results in literature are not applicable.

(ii) Analytic solution for second order fractional differential equation model for RLC circuit by Jignesh P. Chauhan, Sardar Vallabhnbhai National Institute of Technology, Surat. impulse.nit07@gmail.com

In this paper, we discuss second order fractional differential equation model for RLC circuit with arbitrary non-integer order. Further, we use Laplace transform method including convolution theorem to obtain the solution.

(iii) Extensions of almost-F- and F- Suzuki contractions with graph and some applications to fractional calculus by Lokesh M. Budhia, Sardar Vallabhnbhai National Institute of Technology, Surat. lokesh86budhia@gmail.com

In this paper, we introduce two new concepts of α - type almost- F -contraction and α -type F -Suzuki contraction and prove some fixed point theorems for such mappings in complete metric space. Some examples and an application to the non-linear fractional differential equation are given to illustrate the usability of the new theory.

(iv) FK space and Frechet space for a class of entire Dirichlet series in two variables by Lakshika Chutani, Netaji Subhas Institute of Technology, Sector 3 Dwarka, New Delhi-110078. akshika91.chutani@gmail.com

The present paper deals with the class K of entire functions represented by Dirichlet series in two variables for which $|\lambda_{nmn}|^{c_1} |\lambda_{nmn}|^{c_2} e^{(c_2|m|-c_1)|\lambda_{nmn}|} |\lambda_{nmn}|^{\|a_m\|}$ is bounded. K is thereby proved to be a complex FK -space and a Frechet space.

(v) On some properties of compact operators in Felbin's fuzzy normed space by Mami Sharma, Tezpur University, Napaam, Assam-784028, mami@tezu.ernet.in

The objective of our present work is to develop fuzzy analogues of some of the results of compact operators in classical normed spaces. In the classical functional analysis, compact operators are of great importance. They play a central role in various problems of mathematics and physics due to their close resemblance with the operators on finite dimensional spaces. Also one of the nicest things that can be done with compact operators is the study of their spectral properties. Hence it will be interesting to study fuzzy type of them which would have a wide range of applicability.

With the notion of a fuzzy normed space as given by Felbin in 1992, the development of the subject fuzzy functional analysis opens up the possibility of study of fuzzy operator theory. Then Xiao and Zhu and Sadeqi and Salehi introduced the important notion of compact operators in fuzzy normed spaces.

In our paper, with Sadeqi and Salehi's notion of fuzzy compact operators, we have generalized some of the important properties of fuzzy compact operators in fuzzy normed spaces. Also we have proved an analogous of the much celebrated Riesz Lemma in fuzzy setting.

Our work is an attempt to contribute towards a more cohesive framework for the study of compact operator in fuzzy normed spaces.

Abstract of Papers received for presentation

Section A: Combinatorics, Graph Theory and Discrete, Mathematics:

Convex fuzzy set, balanced fuzzy set and absolute convex fuzzy set in a fuzzy vector space by M. Z. Alam, Millat College, Darbhanga-846004. malam035@gmail.com

In this paper, we have studied the absolute convex fuzzy set over a fuzzy vector space. We examine the properties of absolute convex fuzzy set, and established some independent results under the linear mapping from one vector space to another one.

Zero divisor graph for the product ring of finite commutative rings of integers modulo positive integral powers of primes by Lipika Mazumdar, School of Science and Engineering, Navrachana University, Vadodara. lipikam@nuv.ac.in

This paper deals with the construction of zero divisor graph for a ring which is the direct product of finite commutative rings $\mathbb{Z}_{p_1^{n_1}}$ and $\mathbb{Z}_{p_2^{n_2}}$, the ring of integers under addition and multiplication modulo $p_1^{n_1}$ and $p_2^{n_2}$ for prime numbers p_1, p_2 and natural numbers n_1, n_2 . The method of construction of the zero divisor graph has been extended to the direct product of three commutative rings $\mathbb{Z}_{p_1^{n_1}}, \mathbb{Z}_{p_2^{n_2}}$ and $\mathbb{Z}_{p_3^{n_3}}$ and finally, a generalized method has been developed to construct the zero divisor graph of a ring which is the direct product of the rings $\mathbb{Z}_{p_1^{n_1}}, \mathbb{Z}_{p_2^{n_2}}, \dots, \mathbb{Z}_{p_m^{n_m}}$. Also, as a special case, the zero divisor graph of the product ring $\mathbb{Z}_{p_1} \times \mathbb{Z}_{p_2} \times \dots \times \mathbb{Z}_{p_m}$ has been completely characterized for all values of m .

On the chromatic number of the Nil Graph of a commutative ring by Shazida Begum, Kuntala Patra and Sanjoy Kalita, Gauhati University, Guwahati. Let R be a commutative ring and $N(R)$ be the set of all nil-elements of R of index

two, that is, $N(R) = \{x \in R \mid x^2 = 0\}$. A kind of graph structure $\Gamma_N(R)$, can be defined, on the ring R , with the vertex set $\mathbb{Z}_N(R)^* = \{x \in R^* \mid xy \in N(R)\}$, for some y in $R^* = \{R \setminus \{0\}\}$ where any two distinct vertices x and y are adjacent if and only if $xy \in N(R)$. This graph will be referred to as nil graph of R . The ring $R = \mathbb{Z}_m \times \mathbb{Z}_n$ is considered in this paper for studying the graph structure of $\Gamma_N(\mathbb{Z}_m \times \mathbb{Z}_n)$. The chromatic number of the graph $\Gamma_N(\mathbb{Z}_m \times \mathbb{Z}_n)$, for some values of m and n are also determined in this paper.

Intuitionistic fuzzy soft generalized graph structures with application of morphological operators by Ramkumar P.B. Cochin, rkpbumaths@yahoo.co.in
Fuzzy sets (IFS) introduced by Zadeh, in 1965 has various applications in almost all fields of science and technology. In fuzzy set theory, membership of an element to a fuzzy set is a single value between zero and one. A generalization of fuzzy set was proposed by Atanassov as intuitionistic fuzzy sets (IFS) which includes the degree of hesitation. The notion of defining intuitionistic fuzzy set as generalized fuzzy set is useful in many application areas. In 1975 Rosenfeld introduced the concept of fuzzy graphs. The fuzzy relations between fuzzy sets were also considered by Rosenfeld. He developed the structure of fuzzy graphs. This has analogy with several graph theoretical concepts. Bhattacharya gave some remarks on fuzzy graphs, and some operations on fuzzy graphs were introduced by Mordeson and Peng. Mathematical Morphology is another powerful branch which deals with operators required for information processing. Mathematical Morphology is based on the algebraic framework of complete lattices. Graph Morphology deals with the morphological operators defined on Graph. In this paper, we extended these ideas to define intuitionistic fuzzy soft graphs, multi intuitionistic fuzzy soft graphs and morphological operations on fuzzy graphs.

Application of weighted soft fuzzy rough set to multi-criteria decision making on e-commerce by M. Suraiya Begum and M. Sheik John, N. G. M College, Pollachi 642 001. suraiya0291@gmail.com and sheikjohn@gmail.com

The problem of decision-making is an important skill for business and life and is the core of managerial activities in an organization. There are processes and techniques to improve decision-making and the quality of decisions. E-Commerce is a modern methodology offers various business opportunities which has been adopted widely in most enterprises. Many IT and E-businesses cannot be completed on-time and on-budget because of various risks associated in E-commerce. In this paper we concentrate our discussion to analyze the various kinds of risks associated with different electronic businesses and present a methodology that can be used to select the optimum business which addresses the needs of organizations, merchants and consumers. Meanwhile, it is very difficult for the classical soft set and its extensions to deal with such cases. The purpose of this work is to extend the concept of soft fuzzy rough set by assigning weights to parameters. The remainder of this paper is organized as follows: Preliminaries, Risk analysis, Application of weighted soft fuzzy rough set to decision making on E-commerce. Finally the conclusions are given.

Multi attribute decision making in hexagonal intuitionistic fuzzy environment by Thamaraiselvi A. and Santhi R., NGM College, Pollachi.

As a generalization of fuzzy sets, intuitionistic fuzzy sets have been introduced to deal uncertain information present in real world problems. The concept of intuitionistic fuzzy numbers plays a vital role in decision making problems with ill known data. In this paper, we introduced hexagonal intuitionistic fuzzy numbers which is a special case of intuitionistic fuzzy numbers in decision making problems. Firstly, score function and accuracy function of hexagonal intuitionistic fuzzy number are

defined. Then three aggregated operators namely, Hexagonal Intuitionistic Fuzzy Weighted Geometric Operator, Hexagonal Intuitionistic Fuzzy Ordered Weighted Geometric Operator and Hexagonal Intuitionistic Fuzzy Hybrid Geometric Operator are introduced to aggregate a collection of hexagonal intuitionistic fuzzy numbers. Moreover a decision making algorithm based on hexagonal intuitionistic fuzzy numbers is given. In addition, a numerical example is given to check the effectiveness of the algorithm in hexagonal intuitionistic fuzzy environment.

A Characterization of Cocircuits of an *es*-Splitting Matroid by P. P. Malavadar, MIT College of Engineering, Pune-411038. pmalavadar@gmail.com
The *es*-splitting operation for binary matroids is a natural generalisation of Slater's *n*-line splitting operation on graphs. In this paper, we characterize the cocircuits of an *es*-splitting binary matroid M_X^e in terms of the cocircuits of the original binary matroid M .

Section B: Algebra, Number Theory and Lattice Theory:

An ideal hereditary radical for LP-near-rings by Ravi Srinivasa Rao, Cheruvu Krishnaveni and K.J. Lakshmi Narayana, R. V. R. and J. C. College of Engineering, Chowdavaram, Guntur, Maris Stella College, Vijayawada, kchervu@yahoo.com
Jacobson radical of type-3, J_3 , is introduced for LP-near-rings. It is shown that it is ideal hereditary radical in the class of all zero-symmetric LP-near-rings.

Strong regularity and related concepts by Manoj Kumar Manoranjan, T. P. College, Madhepura-852113. manojmanoranjan.kumar@gmail.com

In this paper we have generalized some properties of strongly reduced near-rings. We have characterized some results on strong regularity in near-rings which are closely related with strongly reduced near-rings. A near-ring is said to be left regular if for each $a \in R$, there exists $x \in R$ such that $a = xa^2$. A near-ring is called strongly left regular if R is left regular and regular, similarly we define right regular. A strongly left and strongly right regular near-ring is called strongly regular near-ring. We find that the concept of left, strongly left, strongly right and strong regularities are all equivalent. A near-ring R is reduced if R has no non-zero nilpotent elements. That is, for each a in R , $a^n = 0$ for some positive integer n implies $a = 0$. A near-ring is strongly reduced, if for each $a \in R$, $a^2 \in R_c$ that is $a_0 = a^2$ implies $a_0 = a$. We find that a strongly regular near-ring is reduced and every strongly reduced near-ring is reduced.

Centralizing mappings on semiprime rings by A.R. Gotmare, GDM Arts KRN Commerce and Science College, Jamner, Jalgaon. gotmarear@gmail.com

We prove that if T is an endomorphism of 2-torsion free semi prime ring R such that the mapping $x \rightarrow [T(x), x]$ is commuting on R i.e. $[[T(x)], x] = 0$ for all $x \in R$, then $([T(x), x])^2 = 0$ for all $x \in R$. Consequently, If T is centralizing on R , then it is commuting on R .

IA-automorphisms of finitely generated *p*-groups by R.G. Ghumde, Ramdeobaba College of Engineering and Management, Nagpur-440013, ranjitghumde@gmail.com

In this paper, we find the lower and upper bounds for $IA(G)$ for a finitely generated *p*-group G . By using these bounds number of results on *IA*-automorphisms have been proved.

Theory of Jacobson radical of a ternary hemiring by R.D. Giri and B.R. Chide, RCOEM, Nagpur-440013

A hemiring is a ring without subtraction may not have identity and commutativity of multiplication. If we replace binary multiplication by ternary multiplication in

a hemiring, it is called a ternary hemiring. Three different approaches of Jacobson radical is already studied by us. We improve those results to ternary hemirings. Dutta and Kar have studied some results on Jacobson radical of a ternary semiring. Our results are much more improvised.

On the class-number of the maximal real subfield of a cyclotomic field by Azizul Hoque and Helen K. Saikia, Gauhati University, Guwahati.
ahoque.ms@gmail.com

For any square-free positive integer m , we consider $H(m)$ be the class-number of the field $Q(\zeta_m + \zeta_m^{-1})$, where $\zeta(m)$ is a primitive m -th root of unity. We show that if $m = (3(8g + 5))^2 2$ is a square-free integer, where g is an integer, then $H(4m) > 1$. We also show that the similar result holds for a square-free integer $m = (3(8g + 7))^2 - 2$ is a squarefree integer, where g is an integer. Furthermore, we establish that $n|H(4m)$ for certain values of m and n .

A note on ξ -torsion modules by Himashree Kalita, Helen K. Saikia and Azizul Hoque, Gauhati University, Gauhati, Assam-781014, himashree.kalita28@gmail.com
For a set ξ of some right ideals of an associative ring R and for a right R -module M , we consider the subset $\mathcal{T}_\xi M = \{m \in M \mid mI = 0, \text{ for some non zero } I \in \xi\}$ of M . In general, the subset $\mathcal{T}_\xi(M)$ is not a submodule of M . If $\mathcal{T}_\xi(M)$ is a submodule of M , then we say M is ξ -torsionable module. If $\mathcal{T}(M) = M$, we say that M is ξ -torsion while if $\mathcal{T}(M) = 0$, we say that M is ξ -torsion-free module. We investigate many properties of these modules. We characterize ξ -torsion modules and ξ -torsion-free modules using short exact sequences, module homomorphisms, factor modules, multiplication modules, direct products, direct summand and module extensions.

New avatars of gamma near ring inheriting derivations on the original gamma near ring by A. V. Ramkrishna and T. V. N. Prasanna.

In this paper we study how a gamma near ring can be modified into a new gamma near ring by means of "semilinear-like" functions and how derivations on the original gamma near ring remained derivations on the changed version.

Turning near rings into new near rings by A.V. Ramkrishna and T.V.N. Prasanna.

In this paper we construct new near rings N_f from near rings N through semilinear-like mappings and study how nice properties by one of them are enjoyed by the other. It is gratifying to note that almost all nice properties usually imposed upon them are inherited by the other with the imposition of subjectivity on f as and when needed.

A generalization on regularity concept of a near-ring by Shankar Rajak, B. N. Mandal University, Madhepura, maakalashoolmath@gmail.com

In this paper we have generalized some results on regularity concept of a near-ring by imposing regularity condition over a near-ring and introduced some results.

Formula of an unknown term in a Tetranacci-like sequence by Gautam S. Hathiwala and Devbhadra V. Shah, C.K. Pithawala College of Engineering and Technology, Surat, P.T. Sarvajanic College of Science, Surat,
gautam.hathiwala@ckpcet.ac.in, drdvshah@yahoo.com

Given any four arbitrary real numbers g_1, g_2, g_3 and g_4 , we insert n term between g_3 and g_4 such that these $(n + 4)$ terms satisfies the tetranacci recurrence relation. In fact we derive the general formula for all these terms inserted between g_3 and g_4 .

Baer ideals in 0-distributive posets by Nilesh D. Mundlik, Nowrosjee Wadia

Collge, Pune-411001, mundliknilesh@gmail.com

In this paper, we study Baer ideals in posets and obtain some characterizations of Baer ideals in 0-distributive posets. We consider a relation \sim on Q as $x \sim y$ if and only if $x^\perp = y^\perp$. We show that the $[Q]$, the set of all equivalence classes of Q is always an SSC poset. In the last section we characterize $P(Q)$, the poset of prime ideals of Q , in terms of different kind of prime ideals including Baer ideals.

Unitification of weakly P.Q.-Baer rings by A.S. Khairnar, A. G. College, Karve Road, Pune-411004, anil.maths2004@yahoo.com

S. K. Berberian raised the following problem with a partial solution. "Can every weakly Rickart -ring be embedded in a Rickart -ring? with preservation of RPs?" Thakare and Waphare gave more general partial solution to the above problem. In this paper we raise the following problem. "Can every weakly p.q.-Baer -ring be embedded in a p.q.-Baer -ring? with preservation of central covers?" We give the partial solution to this problem analogous to the partial solution given by Thakare and Waphare.

When is the ideal-based annihilating ideal graph of a commutative ring complemented or uniquely complemented? by HIREN D. PATEL, Government Polytechnic, Bhuj 370001, hdp12376@gmail.com

Let R be a commutative ring with nonzero identity. An ideal I of a ring R is called an annihilating ideal if there exists $r \in R \setminus \{0\}$ such that $Ir = (0)$. Let $N_I(R)$ be the set of all ideals of R those are not contained in I . In this article, we consider the annihilating ideal graph of R with respect to I , denoted by $AG_I(R)$. It is an undirected graph with vertices $\{A \in N_I(R) \mid AB \subseteq I \text{ for some } B \in N_I(R)\}$ and two distinct vertices A and B are adjacent if and only if $AB \subseteq I$. In this paper, necessary and sufficient conditions are determined in order that $AG_I(R)$ is complemented or uniquely complemented.

Section C: Real and Complex Analysis

Third Hankel determinant for reciprocal of bounded turning function has a positive real part of order α by B. Venkateswarlu and N. Rani, GIT, GITAM University, Visakhapatnam-530 045, Praveenya Institute of Marine Engineering and Maritime studies, Visakhapatnam-534 002, bvlmaths@gmail.com, raninekkanti1111@gmail.com

The objective of this paper is to obtain an upper bound to the third Hankel determinant denoted by $|H_3(1)|$ for certain subclass of univalent functions, using Toeplitz determinants.

Convolution theorem for distributional Fourier-Laplace transforms by V. D. Sharma and A.N. Rangari, Arts, Commerce and Science College, Amravati-444606. Adarsh College, Dhamangaon Rly.-444709, vdsharma@hotmail.co.in

In the tremendous expanding knowledge of science, mathematics plays a vital role. In the words of Philip, Mathematics is a science of quantity and space. Especially in quantum field theory, field of partial differential equations, Harmonic analysis etc. the notion of generalized functions is very essential. The convolution theorem of the transform plays an important role in digital signal processing. The usefulness of convolution theorem can be best explained by its application in filtering.

This paper is concerned with the generalization of Fourier-Laplace transform in the distributional sense. The main aim of this paper is to prove the properties of convolution and Convolution theorem for Fourier-Laplace transform.

Certain results on a class of entire functions represented by vector valued Dirichlet series by Garima Manocha, Netaji Subhas Institute of Technology,

Dwarka, New Delhi-110078, garima89.manocha@gmail.com

The present paper refers to a class F of entire Dirichlet series whose coefficients belong to a commutative Banach algebra with identity for which $ne^{\lambda ne}(n!)|an|$ is bounded. Then F is proved to be a commutative Banach algebra with identity, Total set and it fails to become a Division algebra. Conditions for the existence of inverse, topological zero divisor and continuous linear functional for any element belonging to F have also been established.

Number of zeros of polar derivatives of polynomials with special coefficients by P. Ramulu , G. L. Reddy and C. Gangadhar, Govt. Degree College, Wanaparthi, Palamuru University, School of Mathematics and Statistics, University of Hyderabad, ramulu.purra@gmail.com

Let $D_\alpha P(z) = nP(z) + (\alpha z)P'(z)$ denote the polar derivative of a polynomial $P(z)$ of degree n with respect to real or complex number α . The polynomial $D_\alpha P(z)$ is of degree at $DP(z)$ most $n - 1$ and it generalizes the ordinary derivative in the sense that $\lim_{\alpha \rightarrow \infty} \frac{D_\alpha P(z)}{\alpha} = P'(z)$. We find the maximum number of zeros of polar derivatives of polynomials by considering more general coefficient conditions in a prescribed region and the results which we obtained generalize and improve upon some well known results.

Zero-free region for polynomials with restricted real coefficients by P. Ramulu, G. L. Reddy and C. Gangadhar, Govt. Degree College, Wanaparthi, Palamuru University, School of Mathematics and statistics, University of Hyderabad, gangadharmath@gmail.com

In this paper we prove some extensions of the well known Enestro m -Kakeya theorem which states that if $P(z) = \sum_{i=1}^n a_i z^i$ be a polynomial of degree n such that $0 < a_n \leq a_{n-1} \leq \dots \leq a_1 \leq a_0$ then $P(z)$ does not vanish in $|z| < 1$. By relaxing the hypothesis of this result in several ways we obtain zero-free regions for polynomials with restricted coefficients and there by present some interesting generalizations and extensions of the Enestro m -Kakeya Theorem.

Some normality criteria by Gopal Datt and Sanjay Kumar, University of Delhi, Delhi-110 007, ggopal.datt@gmail.com

In this article we prove some normality criteria for a family of meromorphic functions which involves sharing of a non-zero value by certain differential monomials generated by the members of the family. These result generalize some of the results of Schwick.

Meromorphic function sharing a small function with a homogeneous differential polynomial by Indrajit Lahiri and Bipul Pal, University of Kalyani, Kalyani, Nadia, West Bengal 741235, palbipul86@gmail.com

In the paper we study a typical problem arisen from the famous Bruck's conjecture of the value distribution theory concerning the uniqueness of an entire function and its derivative when they share a finite complex value with its derivative counting multiplicity. A similar result, known as Bruck's theorem, was established by Bruck himself under particular conditions and in later stages, the result was developed and generalised gradually by many mathematicians for a differential polynomial of a function instead of its derivatives and for a small function instead of a finite value and for a meromorphic function instead of an entire function etc. Here our main objective is to find a typical version of this result for a meromorphic function sharing a small function counting multiplicity with its homogeneous differential polynomial under certain condition.

Semigroups of transcendental entire functions and their dynamics by Dinsh Kumar and Sanjay Kumar, Deen Dayal Upadhyaya College, University of

Delhi, Delhi-110 015, dinukumar680@gmail.com

Semigroups of transcendental entire functions and their dynamics investigates the dynamics of transcendental semigroups using Fatou-Julia theory. Several results of the dynamics associated with iteration of a transcendental entire function have been extended to transcendental semigroups. We provide some condition for connectivity of the Julia set of the transcendental semigroups. We also study finitely generated transcendental semigroups, abelian transcendental semigroups and limit functions of transcendental semigroups on its invariant Fatou components.

Computation on the comparative growth analysis of entire functions depending on their generalized relative orders by Sanjib Kumar Datta, Tanmay Biswas and Jinarul Haque Shaikh, University of Kalyani, Jnrllhkqkh188@gmail.com
In this paper we study some comparative growth properties of composite entire functions in terms of their maximum terms on the basis of their generalized relative orders (generalized relative lower orders) with respect to another entire function.

Relative L -type and relative L -weak type connected growth properties of composite entire and meromorphic functions by Sanjib Kumar Datta, Tanmay Biswas and Pulak Sahoo, University of Kalyani, pulak.pmath19@gmail.com
In the paper we establish some new results depending on the comparative growth properties of composite entire or meromorphic functions using relative L -type and relative L -weak type as compared to their corresponding left and right factors.

Some study on the growth properties of composite entire functions represented by vector valued Dirichlet series in the light of relative Ritt orders by Sanjib Kumar Datta, Tanmay Biswas and Pranab Das, University of Kalyani, pranabdas90@gmail.com

For entire functions, the notions of their growth indicators such as Ritt order is classical in complex analysis. But the concepts of relative Ritt order of entire functions and as well as their technical advantages of not comparing with the growths of $exp\ expz$ are not at all known to the researchers of this area. Therefore the studies of the growths of composite entire functions in the light of their relative Ritt order are the prime concern of this paper. Actually in this paper we establish some newly developed results related to the growth rates of composite entire functions on the basis of their relative Ritt order (respectively relative Ritt lower order).

On sum and product theorems related to relative L^* -type and relative L^* -weak type of entire functions by Sanjib Kumar Datta, Tanmay Biswas and Ahsanul Hoque, University of Kalyani, ahoque033@gmail.com
In this paper we would like to investigate some basic properties of relative L^* -type and relative L^* -weak type of entire functions.

Comparative growth properties of composite entire and meromorphic functions on integer translation applied upon them by Samten Tamang and Nityagopal Biswas, University of Kalyani, samtentamang@yahoo.in, nitya-maths@gmail.com

In the paper, we study some comparative growth properties of composite entire and meromorphic functions by using integer translation upon them.

Hardy type integral inequalities for quasi-monotone functions by Pankaj Jain, Monika Singh and Arun Pal Singh, Lady Shri Ram College for Women, University of Delhi, New Delhi - 110 003, monikasingh@lrsr.du.ac.in

We consider quasimonotone functions and discuss various Hardy type integral inequalities on weighted Lebesgue and grand Lebesgue spaces. Moreover, we discuss some reverse inequalities as well.

A new class of unique and reduced unique range set by Abhijit Banerjee and Sanjay Mallick, University of Kalyani. smallick.ku@gmail.com, sanjay.mallick1986@gmail.com

After five decades of famous Five Value, Four Value Theorem of R. Nevanlinna, F. Gross pioneered the value sharing to set sharing problem and hence the notion of unique range set stepped into the literature.

In the mean time the scaling between CM and IM i.e., the notion of weighted sharing introduced by I. Lahiri further add essence to the uniqueness literature. Recently under the aegis of weighted sharing the notion of unique range set has been generalized in the following manner.

A set $S \subset \mathbb{C} \cup \{\infty\}$ is called a unique range set for meromorphic (entire) with weight k if for any two non-constant meromorphic (entire) functions f and g , $E_f(S, k) = E_g(S, k)$ implies $f \equiv g$. We write S is URSMk (URSEk) in short.

Obviously when $k = \infty$ or $k = 0$, the definition coincides with the usual definition of URSM and URSM-IM respectively. Till date only two different types of unique range sets have been provided by the researchers and the best possible result have been obtained so far by Frank- Reinders and S. Bertels with 11 elements CM and 17 elements IM respectively. In this paper we have introduced a new class of Unique Range Set which also improves the result obtained by Frank-Reinders and S. Bartels respectively.

Coefficient inequalities and Yamashita's conjecture for some classes of analytic functions by Md Firoz Ali and A. Vasudevarao, Indian Institute of Technology Kharagpur, ali.firoz89@gmail.com

In this talk, we consider two subclasses of analytic functions in the unit disk $z < 1$ of the form $f(z) = z + \sum_{n=2}^{\infty} a_n z^n$ and investigate various properties of these classes, namely, coefficient bounds, inverse coefficient bounds, growth and distortion theorem, radius of convexity and the upper bounds for the Fekete-Szegő functional $\Lambda_\lambda(f) = a_3 \lambda a_2^2$. Further, we solve Yamashita's conjecture for one of these classes which is nothing but the maximal area problem for functions of the type $z/f(z)$.

Coefficient bounds for second Hankel determinants for Some subclasses of Bi-univalent functions by T. Ram Reddy, R. B. Sharma and K. Rajya Laxmi, University Arts and Science College, Warangal-506009, SR International Institute of Technology, Hyderabad-501301, reddytr2@gmail.com

In this paper, we have investigated two sub-classes $N(\alpha, \beta)$ and $M(\alpha, \beta)$ of analytic and Biunivalent functions in the open unit disc Δ . For functions belonging to these classes we obtain an upper bound for second Hankel determinant $H_2(2)$.

On subclass of analytic functions and Hadamard product by Mohandas and Ramesha C., Manipal Institute of Technology, Manipal University, Manipal, mohandas.ram@manipal.edu

The main object of the present paper is to introduce certain new subclasses of analytic functions defined by the Hadamard product, to characterize and to investigate their inclusion properties.

Application of two-dimensional fractional cosine transform to differential equation by V.D. Sharma and S.A. Khapre, Arts, Commerce and Science College, Amravati-444606, vdsharma@hotmail.co.in, P.R. Patil College of Engineering & Technology, Amravati-444604.

Fractional cosine and sine transform are closely related to fractional Fourier transform which is most essential tool in the theory of optics and signal processing. Hence these transform are also used suitably in optics and signal processing as it reduces complexities of computation. The aim of this paper is we introduced new

differential operator and also its adjoint operator.

Construction of subclasses of univalent harmonic mappings by Sumit Nagpal and V. Ravichandran, Ramanujan College, University of Delhi, Delhi, sumitnagpal.du@gmail.com, Department of Mathematics, University of Delhi, Delhi
Construction of subclasses of univalent harmonic mappings employs a new methodology to construct subclasses of univalent harmonic mappings from a given subfamily of univalent analytic functions. Complex-valued harmonic functions that are univalent and sense-preserving in the open unit disk are widely studied. In 1984, Clunie and Sheil-Small introduced the method of shear construction to construct univalent harmonic mapping with a specified dilatation onto a domain convex in one direction. In this paper, the notion of harmonic analogue is introduced and its properties are investigated. The harmonic analogues of some well-known subclasses of normalized analytic univalent functions are also determined. In addition, the notions of harmonic Alexander operator and harmonic Libera operator are introduced and their geometric properties are investigated with illustrations.

Absolute convergence of multiple Fourier series of functions of $\phi(\wedge^1, \dots, \wedge^N)$ -bounded variation by Bhikha Lila Ghodadra, The Maharaja Sayajirao University of Baroda, Vadodara-390 002. bhikhu_ghodadra@yahoo.com
In this paper, we prove a sufficient condition for the absolute convergence of multiple Fourier series of a function of $\phi(\wedge^1, \dots, \wedge^N)$ -bounded variation which extends corresponding known result for single Fourier series. We apply the classical technique of summation by parts and Jensen's inequality to prove our main result.

Third Hankel determinants for transforms of star like and convex functions by R.B. Sharma and M. Haripriya, Kakatiya University, University Arts and Science College, Warangal, 506009.

The objective of this paper is to obtain an upper bound for the third Hankel determinant associated with the k^{th} root transformation $\{f(z^k)\}^{1/k}$ of normalized analytic function f belonging to the class of starlike and convex functions defined on the open unit disc in the complex plane using Toeplitz determinants.

On a class of convex functions subordinate to a shell shaped region by R.B. Sharma and M. Haripriya, Kakatiya University, University Arts and Science College, Warangal, 506009.

The purpose of this paper is to provide further results for a class of star like functions $C(q)$ consisting of analytic functions f normalized by $f(0) = f'(0) - 1 = 0$ in the open unit disk Δ satisfying the subordination condition $1 + zf''(z)/f'(z) < \sqrt{(1+z^2)} + z$ for $z \in \Delta$.

On some generalized functions for fractional calculus: A computational approach and applications by S. C. Pandey, Banasthali Vidyapith, Rajasthan, sharedpandey@yahoo.co.in

Fractional calculus is emerging as a significant subject for applied sciences. The basis of the development of this science is the Special functions, which appear in the solution of various applied problems pertaining to applied sciences. In this paper we have presented a review of techniques associated with special functions and fractional calculus. We have also shown some applications of the above discussed techniques.

On some properties of Spider's web by Garima Tomar, Central University of Rajasthan, Kishangarh-305801, Ajmer. tomar.garima10@gmail.com

Infinite spider's web was considered by Rippon and Stallard. We find some results associated with the spider's web. We also give example for which some results hold

good for fast escaping set but not for the levels of fast escaping set.

Section D: Functional Analysis

Fixed point theorems in banach space using noor iteration by D.P. Shukla, Govt. P. G. Science College, Rewa (M.P.), 486001. shukladpmp@gmail.com

In this paper, we have established fixed point theorems in Banach spaces using self mapping, contraction mapping and non expansive mapping and the obtained result can be considered as an extension and generalization of some well known results of fixed point theorems in Banach space which satisfies Opial's condition.

Fixed point theorem satisfying (ξ, η) contractive condition in complete G-metric space by Kavita B. Bajpai and Manjusha P. Gandhi, Karmavir Dadasaheb Kannamwar College of Engineering, Nagpur, Yeshwantrao Chavan College of Engineering, Wanadongri, Nagpur, kavi_baj@rediffmail.com, manjusha_g2@rediffmail.com

In the present paper a unique fixed point theorem for a self mapping satisfying a new (ξ, η) contractive condition in partially ordered complete G-metric space has been proved. The application of main result is to solve the initial value problem for the non homogeneous heat equation in one dimension has discussed in this paper.

Ripplet transform for Boehmians R. Roopkumar, Alagappa University, Karaikudi 630003.

We first correct a mistake on the inversion theorem of ripplet transform in the literature. Next, we prove a convolution theorem for ripplet transform and construct two Boehmian spaces which properly contain ripplet transformable square integrable functions on \mathbb{R}^2 and its image under ripplet transform, by proving the required auxiliary results. Then, we extend the ripplet transform as a continuous, linear, injective mapping between the two Boehmian spaces.

Best proximity point theorems for α -rational cyclic contraction by A. K. Sharma and M.R. Yadav

By using the classical fundamental cyclic contraction and, we introduce the new notion of a rational cyclic contraction, and then we establish some best proximity point theorems for non self mapping in the frame work of complete metric space. Our results generalized and improve some main results in the literature. Some examples are given to support our main results.

An extrapolation result for a generalized class of weights by Arun Pal Singh, Dyal Singh College, New Delhi-110 003, arunpalsingh@dsc.du.ac.in

In this paper we have proved a Rubio De Francia type extrapolation result for $B_{\phi,p}$ -class of weights defined as the collection of weights w (positive, finite almost everywhere measurable functions) for which $\int_r^\infty (\frac{\phi(r)}{\phi(x)})^p w(x) dx \leq c \int_0^r w(x) dx$ holds for all $r > 0$, for some constant $C > 0$, where $\phi(x) = \int_0^x \phi(t) dt$. Also, we have proved an extrapolation result on weighted generalized grand Lebesgue spaces, and as an application we discuss the weighted grand L^p -boundedness of the generalized Hardy averaging operator $S_\phi f(x) := \frac{1}{\phi(x)} \int_0^x f(t) \phi(t) dt$.

A unique common fixed point theorem for sub-compatible mappings & its applications in dynamic programming by Anushri A. Aserkar and Manjusha P. Gandhi, Rajiv Gandhi College of Engineering and Research, Nagpur, Yeshwantrao Chavan College of Engineering, Nagpur, aserkar_aaa@rediffmail.com

In the present paper an attempt has been made to prove a unique common fixed point theorem in complete metric space for four mappings satisfying sub-compatible condition in pairs and generalized ψ contraction condition. The main result is used to obtain common solution of functional equation arising in dynamic programming.

Some results on positive homomorphisms in the tensor product of C^* -algebras by Anamika Sarma and Nilakshi Goswami, Gauhati University, sarma.anamika53@gmail.com

In this paper we have discussed some results regarding positive homomorphism and ideal structure in the tensor product of C^* -algebras. Let A and B be two C^* -algebras and α be a C^* -norm on the algebraic tensor product $A \otimes B$. Let $\Delta(A \otimes_{\alpha} B)$, $\Delta(A)$ and $\Delta(B)$ be the sets of all complex positive homomorphisms on the algebras $A \otimes_{\alpha} B$, A and B respectively. Here, we have shown that there exists a one-to-one correspondence between $\Delta(A \otimes_{\alpha} B)$ and $\Delta(A) \times \Delta(B)$. From a given f in $\Delta(A \otimes_{\alpha} B)$ we have constructed an ideal I of $A \otimes_{\alpha} B$. Using this ideal we form uniquely two other complex positive homomorphisms on the individual C^* -algebras A and B . Conversely from two given positive homomorphisms f_1 in $\Delta(A)$ and f_2 in $\Delta(B)$ we have constructed uniquely a positive homomorphism f in $A \otimes_{\alpha} B$. Different properties of the ideal I constructed by the homomorphism f on $A \otimes_{\alpha} B$ are also investigated here.

On fixed points theorems in dislocated quasi-metric spaces by C.T. Aage, North Maharashtra University, Jalgaon-425 001.

In this paper, we have establish some fixed point theorems and common fixed point theorems in dislocated quasi-metric space.

Weighted spaces related to Bochner integrable functions by Sandhya Jain, Vivekananda College Delhi 110095

Duality is obtained for the space $L_p^w(I, X)$, which is the weighted Lebesgue space that consists of functions having values in a Banach space X .

Section E: Differential Equations, Integral Equations and Functional Equations

Stability analysis of impulsive delay differential equations with effect of delay at the time of impulses by Palwinder Singh and Sanjay K. Srivastava, Lyallpur Khalsa College, Jalandhar, Beant College of Engineering and Technology, Gurdaspur, bolinapalwinder@gmail.com, sks64_bcet@yahoo.co.in

The impulsive differential equations represent a more natural framework for mathematical modeling of many real life situations in the field of engineering, biology, chemistry, physics, control systems, population dynamics etc. as compared to the theory of ordinary differential equations. This paper studies the exponential stability of impulsive functional differential system with the effect of delay at the time of impulses by using Lyapunov functions and Razumikhin technique. This result extends some results existing in the literature and more general in many situations.

Double Laplace transform combined with iterative method for solving non-linear telegraph equation by Ranjit R. Dhunde and G. L. Waghmare, Datta Meghe Institute of Engineering Technology & Research, Wardha, Government Science College, Gadchiroli, ranjitdhunde@rediffmail.com, glwaghmare@rediffmail.com

In the present paper, double Laplace transform combined with Iterative method is applied to solve nonlinear telegraph equation. Illustrative examples are solved to demonstrate the efficiency of the method.

Effectiveness of security force involved in a counter insurgency operation under decapitation warfare incorporating intelligence as a prime factor Lambodara Sahu, College of Military Engineering, Pune-411 031, lsahucme@gmail.com

Now a days, the forces so called security force and insurgents are involved in confrontation with various decapitation strategies comprising undermining operation and ground combat. Considering the objective of the forces, the ground combat may be further subdivided to decapitation combat and regular combat. A counter insurgency operation by the security force may be considered as good as a regular combat with smaller strength involving undermining operations such as precision strike, missile attack, etc., against insurgents to nullify their various decapitation strategies like assassination or abduction of key Govt. officials, ministers and high profile politicians in addition to other undermining operation such as mining roads and bushes used by security force.

For better effectiveness, a force should have reliable intelligence inputs through either human informer or advanced technical instruments like unmanned aerial vehicle, high power telescope etc. Therefore, reliability of intelligence inputs may be incorporated with the decapitation effect multiplier to show the efficiency of combat power transformation for causing attrition to the opposing side.

A conceptual model dealing with certain key operational factors like robustness, undermining effects, reliability of intelligence inputs, break-points, can be developed using the concepts of Lanchestertype equations to project the effectiveness of security force during counter insurgency operation. An analysis through a case study is made to figure out the importance of highly reliable intelligence inputs during a combat operation. In addition to, robustness of security force and use of undermining operation against insurgents to minimise casualties are also a part of discussion.

Existence of mild solutions of abstract fractional differential equations with impulsive conditions by S. Kanjanadevi and A. Anguraj, PSG College of Arts and Science, Coimbatore-14, kanjanadevimaths@gmail.com, angurajpsg@yahoo.com

In this paper, we prove the existence and uniqueness of mild solutions of abstract fractional differential equations with impulsive conditions using contraction mapping principle and fixed point theorem via condensing map. Here, we derive the mild solution of the problem by using resolvent operator for integral equation.

Approximations using Hilbert transform of wavelets by Nikhil Khanna, Varinder Kumar and S. K. Kaushik, University of Delhi, Delhi-110 007, nikkhan-nak232@gmail.com

Hilbert transform of wavelets has been used to approximate functions in $L^2(\mathbb{R})$. It is proved that Hilbert transform of wavelets with many vanishing moments does a good job in approximating smooth functions in $L^2(\mathbb{R})$. We also prove that Hölder continuity of a function helps in the decay of wavelet coefficients and thereby helps in approximating it. Finally, we give a result that relates the Hilbert transform of wavelet with dyadic scale differential operator and use it to decrease the wavelet coefficients.

Necessary and sufficient conditions of solutions for second order nonlinear delay differential equations by S. S. Santra, Sambalpur University, Sambalpur-768019, shyam01.math@gmail.com

In this work, necessary and sufficient conditions are obtained for the solutions of second order delay differential equations of the form $(a(t)x'(t))' + q(t)H(x(t\sigma)) = 0$, $t \geq t_0$, under the assumptions $\int_0^\infty \frac{dt}{a(t)} = \infty$, when G is sublinear and superlinear.

On the controllability of nonlinear fractional delay integrodifferential

systems using Laplace transform by Joice Nirmala Rajagopal, Bharathiar University, Coimbatore, joys.maths.bu@gmail.com

This work concerns the effective ways of solving fractional delay dynamical systems. The main focus is to determine the solution of fractional delay differential equation by combining Laplace transform and method of steps. The solution is compared with the solution obtained in integer order equation. Consequently controllability criteria for both fractional linear and nonlinear delay integrodifferential systems have been studied using fixed point argument. Finally examples are provided with numerical stimulation to verify the results.

Existence of solutions of abstract stochastic quasilinear differential equations by R. Mabel Lizzy, Bharathiar University, Coimbatore-641046, mabel.math.bu@gmail.com

In this paper, the existence and uniqueness of local mild solution to quasilinear equation with additive cylindrical Wiener process in a separable Hilbert space are established using contraction mapping principle. We first show the existence of mild solution of the corresponding linear part, using which we define a contraction map on a suitable complete metric space. The fixed point then obtained using contraction mapping principle represents the mild solution of the quasilinear equation.

Existence and uniqueness of solutions of dissipative dispersive equations by A. Akilandeewari, Bharathiar University, Coimbatore-641046

In this paper we establish the existence and uniqueness of solutions of the modified Korteweg-de Vries equation with higher order nonlinearity. The results are established by using semigroup theory and fixed point theory approach of quasilinear evolution equations.

A frame in Banach spaces by Shah Jahan and Varinder Kumar, University of Delhi, Delhi-110 007, chowdharyshahjahan@gmail.com

The concept of \mathcal{A} -frames in Banach spaces has been defined and studied. A necessary and sufficient condition for the existence of an \mathcal{A} -frame in a Banach space has been given. Also, a sufficient condition, in terms of \mathcal{A} -frame, the existence of bounded approximation property in a Banach spaces has been given. Finally, we define approximative RBF and prove that if a Banach space χ has an \mathcal{A} -frame, then it also has an approximative RBF.

Analysis of integrodifferential equations with small stochastic perturbation by M. Suvinthra, Bharathiar University, Coimbatore, suvinthra@gmail.com

In this work we establish a Freidlin-Wentzell type large deviation principle for stochastic integrodifferential equations by using the weak convergence approach. The compactness argument is proved on the solution space of corresponding skeleton equation and the weak convergence is done for Borel measurable functions whose existence is asserted from Yamada-Watanabe theorem.

Inverse source problems for the phase field system by K. Karuppiah, Bharathiar University, Coimbatore, karuppiahmaths@gmail.com

In this paper we study the inverse problem of determining two source terms in the phase field system. Apart from the initial and Dirichlet boundary conditions, we consider the additional Dirichlet type measured output data. We provide several necessary and sufficient results to prove the existence of a quasi-solution of the considered inverse problem. We study the Frechet derivative of the cost functional via the solution of the adjoint parabolic system and further we prove the Lipschitz continuity of the gradient of the functional and we obtain a monotone iteration scheme based on the gradient method. Finally we study the convexity of the Frechet derivative.

Global existence of solutions of Keller-Segel Chemotaxis systems by Arumugam Gurusamy, DRDO-BU CLS, Bharathiar University, Coimbatore, guru.poy@gmail.com

The main focus of this article is to prove existence of weak solution to the approximate Keller-Segel chemotaxis system with cross-diffusion by using Schauder fixed point theorem. The global existence of solution is obtained by a priori estimates and compactness arguments.

Solution and stability of n-dimensional additive functional equation: Direct and fixed point methods by M. Arunkumar and P. Agilan, Government Arts College, Tiruvannamalai-606 603, S.K.P.Engineering College, Tiruvannamalai-606611, annarun2002@yahoo.co.in, agilram@gmail.com

In this paper, the authors investigate the general solution and generalized Ulam-Hyers stability of a n -dimensional additive functional equation $f(\sum_{i=1}^n ix_i) + \sum_{j=2}^n f(\sum_{i=1, i \neq j}^n ix_i j x_j) + f(x_1 \sum_{i=2}^n ix_i) = (n+1)f(x_1) + (n+3) \sum_{i=2}^n if(x_i)$ with $n > 3$ in Banach spaces by applying direct and fixed point methods.

Bifurcation and stability analysis of a diffusive predator-prey model with ratio-dependent type III functional response by SivakumarMuthusamy and Balachandran Krishnan, DRDO-BU CLS, Bharathiar University, Coimbatore, siva-maths007@gmail.com

This work is concerned with a diffusive Leslie-Gower predator-prey system with ratio dependent Holling type III functional response subject to Neumann boundary conditions. By linearizing the system at the positive constant steady-state solution and analyzing the associated characteristic equation in detail, local stability, existence of a Hopf bifurcation at the co-existence of the equilibrium and stability of bifurcating periodic solutions of the system in the absence of diffusion are studied. Furthermore, Turing instability and Hopf bifurcation analysis for the system with diffusion are studied.

Inverse problems for the reaction-diffusion equation with discontinuous coefficients by Dinakar Varadharaj, Bharathiar University, Coimbatore, dinam.v@gmail.com

First we establish a Carleman estimate for reaction-diffusion equation with variable coefficients. Then the internal observations with single measurement are allowed to obtain the stability result for the inverse problem consisting of retrieving two discontinuous coefficients in the given parabolic equation. The proof of the results relies on Carleman estimates and certain energy estimates for parabolic equations.

Section F: Geometry

On hyperbolic almost kaehlerian spaces admitting geodesic lines of semi-symmetric metric connection by U. S. Negi, H. N. B. Garhwal (Central) University, Tehri Garhwal - 249199, usnegi7@gmail.com

Mizusawa and Koto (1960) have studied holomorphically projective curvature tensors in certain almost Kaehlerian spaces. Also, Prvanovic and Pusic (1995) have studied on manifold admitting some semi-symmetric metric connection. In the present paper, I have defined and studied Geodesic lines on any metric space are autoparallel lines of its Levi-Civita connection. The necessary and sufficient condition for a metric semi-symmetric connection of a hyperbolic almost Kaehlerian space to have some of their autoparallel lines in common with their Levi-Civita connection.

Generalized Sasakian space forms with m-projective curvature tensor by

Jay Prakash Singh, Mizoram University, Aizawl, Mizoram-796004,
jpsmaths@gmail.com

In the present paper, we have studied ϕ mprojectively flat generalized Sasakian space forms, m-projectively locally symmetric generalized Sasakian space forms and m -projectively locally ϕ -symmetric generalized Sasakian space forms. It is proved that a $(2n + 1)$ dimensional ($n > 1$), generalized Sasakian space form is m-projectively locally symmetric if and only if it is conformally flat. Obtained results are supported by illustrative examples.

Control of retailers on transaction by Nilima Puranik, Amolachand
Mahavidyalaya, Yavatmal, nilunarayan@yahoo.co.in

In this research paper with the help of survey method attempt was done to verify whether retailers are gaining large share of profit and having complete control over transactions. Supply Chain Management (SCM), currently a popular topic in research literature, breaches the boundaries of many academic disciplines. Many approaches are used by researchers and practitioners to reduce food loss and waste. To reduce the food loss its important to study and give appropriate action for the entire food supply chain. Most countries at government level use different approaches to minimize loss, for example, at the production stage government supports farmers to improve availability of agricultural extension services, to have market access and to improve harvesting techniques. In addition, improving access for handling and storage, improving processing and packaging technologies, conducting consumer education campaigns, etc. are suggested and used in different areas. In our project we have verified with the help of Chi-square test retailer. We have used Chi-square test for retailer. In this project I want to prepare fuzzy model.

Screen pseudo-slant lightlike submanifolds of indefinite Kaehler manifolds by Akhilesh Yadav, University of Allahabad, Allahabad-211002,
akhilesh_mathau@rediffmail.com

In this paper, we introduce the notion of screen pseudo-slant lightlike submanifolds of indefinite Kaehler manifolds giving characterization theorem with some non-trivial examples of such submanifolds. Integrability conditions of distributions D_1 , D_2 and RadTM on screen pseudo-slant lightlike submanifolds of an indefinite Kaehler manifold have been obtained. Further we obtain necessary and sufficient conditions for foliations determined by above distributions to be totally geodesic.

Lightlike submanifolds of indefinite trans-Sasakian manifolds by Varun Jain, Rachna Rani and R. K. Nagaich, Multani Mal Modi College, Patiala, University College Moonak, Distt. Sangrur, Punjabi University, Patiala,
varun82jain@gmail.com, rachna ucoe@yahoo.co.in, nagaich58rakesh@gmail.com

We prove some results on invariant lightlike submanifolds of indefinite trans- Sasakian manifolds. Then, we introduce general notion of contact Cauchy-Riemann (CR) lightlike submanifolds and study geometric leaves of this distributions. We also study class of contact screen Cauchy-Riemann (SCR) lightlike submanifolds which include invariant and screen real subcases.

GCR-lightlike submanifold of indefinite S -manifolds by Manish Gogna, Varun Jain, Rachna Rani and R.K. Nagaich, Baba Banda Singh Bahadur Engineering College, Fathehgarh Sahib, Multani Mal Modi College, Patiala, University College Moonak, Sangrur, Punjabi University, Patiala, manish bbsbec@yahoo.co.in, rachna ucoe@yahoo.co.in, nagaich58rakesh@gmail.com, rachna.ucoe@yahoo.co.in

In this paper we introduced GCR-lightlike submanifolds of indefinite S -manifolds and obtained existence theorem for GCR-lightlike submanifolds in an indefinite S -space form $M(c)$. Since the induced connection on a lightlike submanifold is not

metric therefore we find necessary and sufficient conditions for the induced connection to be metric. We also find conditions for the leaves of distributions to be totally geodesic submanifolds in an indefinite S -manifold. Finally, we find a characterization theorem for an indefinite S -manifold to be a semi-Euclidean space.

Cubic trigonometric Bezier curve with shape parameter by Reenu Sharma, Mata Gujri Mahila Mahavidyalaya, Jabalpur, reenusharma6@rediff.com

A class of cubic trigonometric Bzier curve with a shape parameter is presented in this paper. Each curve segment is generated by four consecutive control points. The shape of the curve can be adjusted by altering the values of shape parameters while the control polygon is kept unchanged. These curves are closer to the control polygon than the cubic Bezier curves, for all values of shape parameter. With the increase of the shape parameter, the curve approaches to the control polygon. The effect of the shape parameters on the shape diagram of cubic trigonometric Bezier curve are made clear.

Section G: Topology

A study of order topologies and nets in the bicomplex space by Sukhdev Singh, Lovely Professional University, Punjab 144411, sukhdev.15829@lpu.co.in

In this paper, we have studied the topological properties of the bicomplex space C^2 . We have defined three order topologies and a product topology on C^2 and studied them. We have initiated the study of nets in C^2 . Different types of confinements of bicomplex nets have been characterized in terms of convergence of the components nets. We have also initiated the study of clustering of bicomplex nets. Clustering of different types of zones in C^2 have been defined. We have investigated the confinement and clustering of the bicomplex nets in different order topologies. Finally investigations have been made connecting clustering bicomplex nets and confinements of its subnets.

Some fixed point results for two weakly compatible self maps in cone rectangular metric space under expansive type conditions by P. Mallikarjun Reddy and M. Rangamma, Osmania University, Hyderabad, pagidimallik@gmail.com

In this paper we prove some common fixed point theorems for two weakly compatible self mappings satisfying expansive type conditions in cone rectangular metric spaces.

Elementary investigations in topological dynamics by Kushal Lalwani, University of Delhi, Delhi-110 007, lalwani.kushal@gmail.com

In this article we wish to investigate some elementary problems concerning topological dynamics revolving around recurrent sets and our proposed definition of escaping set. At initial stage we give many examples and non-examples in support of our definition. We propose some conjectures.

A new class of sets weaker than preopen sets by T. Tamizh Chelvam and S. Pasunkili Pandian, Manonmaniam Sundaranar University, Tirunelveli, Aditanar College, Tiruchendur, pasunkilipandian@yahoo.com

The aim of this paper is to introduce a new class of sets, namely Semi*-preopen sets. We find Charaterizations of semi*-preopen sets. We also define the semi*-preinterior of a subset. Further we investigate fundamental properties of semi*-preopen sets.

Generalization of fuzzy open sets by P. Thangavelu and P. Xavier, Karunya University, Coimbatore-641 114,ptvelu12@gmail.com, pxavier24@gmail.com
Bageerathi and Thangavelu introduced and studied the concept of fuzzy C-closed

sets using the arbitrary complement function $C : [0, 1] \rightarrow [0, 1]$ and characterized some concepts in fuzzy topological spaces. The purpose of this paper is to introduce fuzzy C -open sets and characterize fuzzy compactness and fuzzy continuity.

Section H: Measure Theory, Probability Theory and Stochastic Processes, and Information Theory

New transform techniques for cryptography by A.P. Hiwarekar, VPK Bajaj
Institute of Engineering and Technology, Baramati, hiwarekaranil@gmail.com
Information security has become a very critical aspect of modern computing system. Information security is mostly achieved through the use of cryptography. Cryptography provides privacy and security for the secret information by hiding it. It is done through mathematical techniques. Cryptography has many applications in Banking, Security, One time password generation and many more areas. In this paper we developed new methods for cryptography in which we will apply suitable integral transform of function for encrypting the plain text and we will apply corresponding inverse transform for decryption. We also developed iterative method for encryption and corresponding decryption. Finally these results are obtained in the generalized form. We also developed the corresponding encryption algorithm for this method. The new scheme developed in this paper may be used for a fraud prevention mechanism as well as for the data security.

Section I: Numerical Analysis, Approximation Theory and Computer Science

A numerical scheme for second order singularly perturbed delay differential equations via cubic spline in tension by P.P. Chakravarthy and S. Dinesh Kumar, Visvesvaraya National Institute of Technology, Nagpur - 440010, pramodpodila@yahoo.co.in, mathdinesh005@gmail.com

This paper deals with the singularly perturbed boundary value problem for the second order delay differential equation. Similar boundary value problems are associated with expected first-exit times of the membrane potential in models of neurons. A difference scheme on a uniform mesh which is accomplished by the method based on cubic spline in tension. The difference scheme is shown to converge to the continuous solution uniformly with respect to the perturbation parameter is illustrated with numerical results.

Application of genetic algorithm for solving system of nonlinear equations by P.P. Bedekar and S.R. Bhide, Govt. College of Engineering, Amravati, Visvesvaraya National Institute of Technology, Nagpur bedekar_pp@rediffmail.com
This paper presents application of genetic algorithm (GA) for solving system of nonlinear equations. The most popular methods for solving system of nonlinear equations are fixed point iteration method and Newton-Raphson (NR) method. In fixed point iteration method the convergence often depends on the manner in which the equations are formulated. Additionally, even in those instances where convergence is possible, divergence can occur if the initial guesses are insufficiently close to the true solution. Just as fixed point iteration method, the NR approach will often diverge if the initial guesses are not sufficiently close to the true roots. Also, NR method requires the calculation of Jacobian and its inverse which becomes difficult in case of large number of equations. Application of GA overcomes these difficulties. The problem of finding the solution of system of nonlinear equations is formulated as an optimization problem, by defining an objective function which aims at minimizing the sum of square of error between the left hand side and right hand side of each nonlinear equation. GA is then applied to solve this optimization problem. GA, being a multipoint search method, leads to the global optimum solution. It

has been shown in this paper that GA promises to be another effective method of solving system of non linear. It overcomes the drawbacks of fixed point iteration method and NR method. Also, it gives multiple solutions (if exist).

Constrained fractal interpolation with variable scaling by A.K.B. Chand and K.M. Reddy, Indian Institute of Technology Madras, Chennai, chand@iitm.ac.in, mahipalnitw@gmail.com

In this paper, we introduce the rational cubic spline with variable scaling, where the numerator is a cubic polynomial and the denominator is a linear function. We derive sufficient condition on the parameter of rational iterated function system, so that it lies below or above a piece wise linear curve.

A novel approach to preserve positivity of surface data through trigonometric fractal functions by K.R. Tyada and A.K.B. Chand, IIT Madras, Chennai, kurmaths86@gmail.com

This paper explores a new algorithm to prolong the positive behavior of a given curve or surface data using trigonometric fractal functions. Rational fractal functions are more general and advance interpolating techniques than classical counterparts due to the extra availability of scaling factors and shape parameters. We deduced simple data dependent range restrictions on the iterated functions system parameters so that the required fractal functions preserve positivity nature of a given positive curve or surface data. Numerical examples are added to show our model is well needed in the field of rough functions.

Section J: Operations Research

Solving multi-objective transportation problem to reduce transportation cost and time by Gaurav Sharma, S. H. Abbas and V. K. Gupta, IES Institute of Technology & Management, Saifia Science College, UIT RGPV Bhopal, sharma.13g11@gmail.com

In this paper we study the multi-objective transportation problem for Procter & Gamble to reduce transportation cost and time of goods supply from one source to another source. To solve this problem we are using a new proposed algorithm which is different form to another existing method. This proposed method providing the support to decision makers for handling time oriented problems.

An approach of membership function in fuzzy transportation problem by Poonam Shugani, S. H. Abbas and V. K. Gupta, Saifia Science College, UIT RGPV Bhopal, punam.shugani.vds.2010@gmail.com

The object of the fuzzy transportation problem is to determine the shipping schedule that minimizes the total fuzzy transportation cost while satisfying fuzzy supply and demand limits. A fuzzy transportation problem basically deals with the problem, which aims to find the best way to fulfil the demand of n demand points using the capacities of m supply points. Here we are using the concept of membership function for solving fuzzy transportation problems with mixed constraints and find an optimal solution. The optimal solution procedure is illustrated with numerical example.

Simulation of dynamic pricing policy with linear demand by U. K. Khedlekar, Doctor Hari Singh Gour Central University, Sagar, uvkkcm@yahoo.co.in

In diminishing market, demand of a product decreases and due to this, product may disappear altogether from the market. One can reduce the selling price and generate the excess demand to earn more and to establish the product in the market. In competitive environment, the strategy is also applicable in entering into

competition with others. The objectives of present paper are to develop a dynamic pricing policy to solve such types of problems in a diminishing market. The problem is solved by coming to terms with Kuhn Tucker imperatives and modalities, in this regard. A simulation study is appended to measure the effect of various parameters on optimal policy. The analysis reveals that for every business setup, there will be an optimal number of price settings for dynamic pricing policy that outperforms the static pricing policy.

Zero suffix method for assignment problem by Shambhu Sharma, Dayalbagh Educational Institute, Agra, ssdei61@gmail.com

In the present paper a maximin zero suffix method for solving the classical assignment problems has been proposed. The algorithm of the method has been given. The computational efficiency of the proposed method is better than that of the existing methods in the literature and it is very simple, easy to understand and apply.

Fuzzy-True: Enhanced prediction accuracy for associative classification by Antara Nandy, B.U. Builders & Consultants Pvt. Ltd., bubuildersconsultants@gmail.com

The name of the paper, Fuzzy-true combining the two words fuzzy and true to create an oxymoron, intends to represent the accuracy that can be achieved by means of fuzzy logic for associative classification. Classification helps to figure out a certain set of rules in the database that form an efficient classifier. Association however uses the association rule discovery technique to build classification systems which are called associative classifiers. Numerous prediction techniques like that based on maximum likelihood or multiple rules, facilitate the process of prediction. The efficiency of the prediction of outcomes plays important role in technological and economic forecasting. Associative classification technique if coupled with fuzzy logic helps raise its utility by a great margin. Fuzzy logic helps to create a comprehensive data-set and adopts an approach with higher efficiency and precision. This paper contains a description about the enhancement that can be achieved when fuzzy logic is integrated with associative classification. It also includes assessment of performance of fuzzy true model using a cumulative method of evaluation.

Section K: Solid Mechanics, Fluid Mechanics, Geophysics and Relativity

The analytic invariants of spherically symmetric space-time in V_4 by P.O. Bagde and K.T. Thomas, RCOEM, SFS College, Nagpur, prafulla.bagde@gmail.com

In this paper we studied the analytic invariants of spherically symmetric space-time by considering the various quadruples of orthogonal unit vectors α_i, β_i and then some results have been developed there upon. Further it is noticed that, for $K_{spsq} = K_{rprq} = K_{rsrs} = K_{ppqq} = 0; p \neq q \neq r \neq s$ and $p, q, r, s = 1, 2, 3, 4$, the quadruple $(\alpha_p, \alpha_q, \alpha_r, \beta_s)$ and $(\alpha_s, \beta_p, \beta_q, \beta_r)$ of the orthogonal unit vector α_i and β_i yield the at geometry of the spacetime if and only if $\sigma^5 = 0$. Also for $K_{rprq} = K_{spsq} = K_{ppqs} = 0$ and $g_{qq}K_{psps} + g_{ss}K_{ppqq} = 0; p \neq q \neq r \neq s; p, q, r, s = 1, 2, 3, 4$ the quadruple $(\alpha_p, \alpha_q, \alpha_r, \beta_s)$ and $(\alpha_s, \beta_p, \beta_q, \beta_r)$ of the orthogonal unit vector α_i and β_i yield $\sigma^4 = \text{constant}$, which leads to the well known theorem of Schur's concerning the space of constant curvature.

LRS Bianchi type-I cosmology with gamma law EoS in $f(R, T)$ gravity by P.K. Sahoo, B. Mishra, Pratishta Shukla and Amritha Jayadev, Birla Institute of Technology and Science-Pilani, Hyderabad, sahoomaku@rediffmail.com

We have studied the locally rotationally symmetric (LRS) Bianchi type-I line element in $f(R, T)$ (R is the Ricci scalar and T is the trace of the stress energy tensor) theory of gravity in presence of EoS parameter. The simplest case, $f(R, T) =$

$R + 2f(T)$ with gamma-law equation of state $p = (\gamma - 1)\rho$ are considered to explore the role of particle creation in the early universe. The exact solutions of the field equations are obtained using the scalar expansion proportional to the shear. The physical and kinematical properties of the model are studied.

Bianchi type-IV space time in dark energy by B. Mishra, P.K Sahoo and Srikanth Suresh, Birla Institute of Technology and Science-Pilani, Hyderabad.

In this paper, non-diagonal Bianchi type-IV space-time is investigated in Einstein general theory of relativity. The matter field is considered in the form of perfect dark energy fluid. It is interesting to observe that in this case, Bianchi type IV perfect dark energy fluid cosmological model does not exist. The space-time reduces to Minkowskian geometry.

Effect of thermal radiation on steady MHD convective flow past a continuously moving vertical plate in a porous medium by Dipak Sarma and Mamani Kalita, Cotton College, Guwahati-1, Gauhati University, Guwahati-14, dipaksarma11@yahoo.com, anamikakalita@gmail.com

This paper focuses on the effect of thermal radiation on a steady two dimensional MHD convective flow of an incompressible viscous electrically conducting fluid past a continuously moving porous plate embedded in a porous medium. A uniform magnetic field is assumed to be applied transversely to the direction of the main flow. The expressions for the velocity field, temperature field, concentration field, skin friction at the plate, Nusselt number and Sherwood number are obtained in non dimensional form for a wide range of the governing flow parameters. The effects of the flow parameters on the velocity, temperature, concentration skin friction coefficient, Nusselt number and Sherwood number are discussed graphically. It is observed that the radiation parameter N decelerates the velocity profile and decreases the magnitude of the temperature distribution and concentration in the boundary layer.

Anisotropic Bianchi type I cosmological models with generalized Chaplygin gas and dynamical gravitational and cosmological constants by S. Kotambkar, R. K. Kelkar and G. P. Singh, Laxminarayan Institute of Technology, Nagpur, S. B. Jain Institute of Technology Management and Research, Nagpur, Visvesvaraya, National Institute of Technology, Nagpur, shubha.kotambkar@rediffmail.com, rupali.kelkar@yahoo.com, gpsingh@math.vnit.ac.in

This paper deals with study of generalized Chaplygin gas model with dynamical gravitational and cosmological constants. In this paper a new set of exact solutions of Einstein field equations for spatially homogeneous and anisotropic Bianchi type I space-time have been obtained. The physical and dynamical behaviors of the model have been discussed with the help of graphical representation.

MHD peristaltic transport of a micropolar fluid in an asymmetric channel with porous medium by S. Sreenadh, P. Lakshminarayana, K. V. V. Satyanarayana and P. V. Arunachalam, Sri Venkateswara University, Tirupati, Sree Vidyanikethan Engineering College, Tirupati, Dravidian University, Kuppam, Tirupati, profsreenadh@gmail.com

In the present study the peristaltic transport of an incompressible conducting micropolar fluid in an asymmetric channel with porous medium has been studied under the assumptions of long wave length and low Reynolds number. Applying wave frame analysis, exact analytical solutions have been obtained for the axial velocity and the microrotation component. Expression for the pressure rise is also obtained. The influence of physical parameters on the velocity, pressure gradient

and pressure rise are presented through graphs. The effect of increase in permeability parameter and Magnetic parameter is to reduce the velocity.

Study of dynamical behavior of cosmological constant Λ and aspects of phenomenological models from Ia supernovae by Gulshan Makkad, Jhulelal Institute of Technology, Nagpur-441111, gmakkad@gmail.com

In this paper, we have solved the Einstein field equation for the scalar factor $R(t)$, density $\rho(t)$ and cosmological term $\Lambda(t)$, by assuming $\Lambda = \mu\dot{H}$, where μ is a parameter of $\Lambda \sim \dot{H}$, in the context of Higher dimension space time. It has been shown that model $\Lambda \sim \dot{H}$, is equivalent to $\Lambda \sim (\frac{\dot{R}}{R})^2$, $\Lambda \sim (\frac{\ddot{R}}{R})^2$ and $\Lambda \sim \rho$ models, when the condition for $R(t)$, $\rho(t)$, and $\Lambda(t)$ are expressed in terms of Ω_m and Ω_Λ , the matter and vacuum energy density of the universe respectively.

$\Lambda(T)$ gravity in $f(R, T)$ modified theory for general class of Bianchi models by Umesh Kumar Sharma, Anirudh Pradhan and Nasr Ahmed, Institute of Applied Sciences and Humanities, GLA University, Mathura-281406, Taibah University, Saudi Arabia, Astronomy Department

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A new class of cosmological models in $f(R, T)$ modified theories of gravity (Harko et al. in Phys. Rev. D 84:024020, 2011), where the gravitational Lagrangian is given by an arbitrary function of Ricci scalar R and the trace of the stress-energy tensor T , have been investigated for a specific choice of $f(R, T) = f_1(R) + f_2(T)$ in a general class of Bianchi universe. Our intention is to reconstruct $f(R, T)$ models inspired by this special law for the deceleration parameter (Akarsu and Dereli in Int. J. Theor. Phys. 51:612, 2012) which is linear in time with negative slope in connection with the theories of modified gravity. In the present study we consider the cosmological constant Λ as a function of the trace of the stress energy-momentum-tensor, and such a model is nicknamed as $\Lambda(T)$ gravity. Such models may exhibit better consistency with the recent cosmological observations. We analyze the variation of pressure, energy density and cosmological term with cosmic time and discuss the physical consequences. We also discuss physical and geometric properties of derived models.

Section L: Electromagnetic Theory, Magneto-Hydrodynamics Astronomy and Astrophysics

In the atmosphere the equations developed from the motion of an axis symmetric body moving by Ashwani Kumar Sinha and M.M. Bajaj, M.M. Mahila College, Ara, Bihar, Department of Physics and Astrophysics, University of Delhi. Initially the work progressed to present a new mathematical of the motion of a spinning axis- symmetric body in the atmosphere. The work is based on the geometrical behaviour of a non- linear differential equation arising one of the motion of an axis symmetric projectile. Naturally, the motion equation available in the subject are first reviewed for their structures viz., reference frames, structure of forces, specification of the spinning body and finally the assumption made to develop the model. The work includes only the free motion of the body in the presence of biquadratic non-linear restoring moment and solutions of such equation.

Section M: Bio-Mathematics

Detection of P and T-waves in ECG Signal by Pankaj K. Gakare, Datta Meghe Institute of Engineering, Technology & Research, Wardha.

Electrocardiogram (ECG) analysis plays vital role in diagnosis of heart diseases. In

order to avoid erroneous conclusions, it is of utmost importance that all the features of ECG waveform are extracted accurately and only sinus rhythms are present in the ECG Signal. Significant features of the ECG include the P wave, the QRS Complex, and the T wave. Determining the position of P wave and T wave is a complicated task due to low amplitude. In this paper simple Low pass differentiation (LPD) based method is proposed for estimation of P and T wave. Locating all the features accurately is essential for the performance of other ECG processing such as signal Analysis, Diagnosis, Authentication and Identification. Performance evaluation of this algorithm is done on recorded ECG signals by holter recorder and MIT-BIH database. Validation of proposed algorithm indicates that it performs satisfactorily with approximate accuracy of 92.46.

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