Annual Report

2010 - 2011

Indian Statistical Institute

PRESIDENT OF THE INSTITUTE, CHAIRMAN AND OTHER MEMBERS OF THE COUNCIL AS ON MARCH 31, 2011

President: Prof. M.G.K. Menon, FRS

1. Chairman: Shri Pranab Mukherjee, Hon'ble Finance Minister, Government of India.
2. Director: Prof. Bimal K. Roy.

Representatives of Government of India

3. Dr. S.K. Das, DG, CSO, Government of India, Ministry of Statistics & Programme Implementation, New Delhi.
4. Dr. K.L. Prasad, Adviser, Government of India, Ministry of Finance, New Delhi.
5. Dr. Rajiv Sharma, Scientist 'G' & Adviser, (International Cooperation), Department of Science & Technology, Government of India, New Delhi.
6. Shri Deepak K. Mohanty, Executive Director, Reserve Bank of India, Mumbai.
7. Shri Anant Kumar Singh, Joint Secretary (HE), Government of India, Ministry of Human Resource Development, Department of Higher Education.

Representative of ICSSR

8. Dr. Ranjit Sinha, Member Secretary, Indian Council of Social Science Research, New Delhi.

Representatives of INSA

9. Prof. V.D. Sharma, FNA, Department of Mathematics, Indian Institute of Technology, Mumbai.
10. Prof. B.L.S. Prakasa Rao, FNA, Dr. Homi J Bhabha Chair Professor, Department of Mathematics and Statistics, University of Hyderabad, Hyderabad.
11. Prof. T.P. Singh, FNA, DBT Distinguished Biotechnologist, Department of Biophysics, All India Institute of Medical Sciences, New Delhi.
12. Prof. Somnath Dasgupta, FNA, Director, National Centre of Experimental Mineralogy & Petrology, University of Allahabad, Uttar Pradesh.

Representative of the Planning Commission

13. Shri B.D. Virdi, Adviser, Perspective Planning Division of Planning Commission, New Delhi.

Representative of the University Grants Commission

14. Prof. S. Mahendra Dev, Director, Indira Gandhi Institute of Development Research, Mumbai.

Scientists co-opted by the Council

15. Prof. Kaushik Basu, Chief Economic Adviser, Department of Economic Affairs, Ministry of Finance, Government of India, New Delhi.
16. Prof. R. Balasubramanian, Director, Institute of Mathematical Sciences, Chennai.

Elected representatives of members of the Institute not employed in the Institute

17. Prof. D. Dutta Majumder, FNA, Emeritus Professor, Indian Statistical Institute, Kolkata.
18. Shri Ajay Kumar Ghosh, Kolkata.
19. Prof. Siddani Bhaskara Rao, Director, C.R. Rao Advanced Institute of Mathematics, Hyderabad

Elected representatives of the employees of the Institute

20. Shri Somnath Ray, Representative of the Scientific Workers.
21. Shri Probir Chattoraj, Representative of the Non-Scientific Workers.

Officers of the Institute

22. Prof. Goutam Mukherjee, Professor-in-Charge, Theoretical Statistics and Mathematics Division.
23. Prof. Subhamoy Maitra, Professor-in-Charge, Applied Statistics Division.
24. Prof. Madhura Swaminathan, Professor-in-Charge, Social Sciences Division.
25. Prof. Sisir Roy, Professor-in-Charge, Physics and Earth Sciences Division.
26. Prof. Bidyut Roy, Professor-in-Charge, Biological Sciences Division.
27. Prof. Subhas Chandra Nandy, Professor-in-Charge, Computer and Communication Sciences Division.
28. Shri Amitava Bandyopadhyay, Head, SQC & OR Division.
29. Prof. R.B. Bapat, Head, Delhi Centre.
30. Prof. T.S.S.R.K. Rao, Head, Bangalore Centre.
31. Dr. D. Sampangi Raman, Officiating Head, Chennai Centre.
32. Prof. Bhabani Prasad Sinha, Dean of Studies.

Non-Member Secretary

Shri S.K. Iyer, Chief Executive (Administration & Finance).

INDIAN STATISTICAL INSTITUTE

Annual Report

April 2010 – March 2011

203 Barrackpore Trunk Road
Kolkata – 700 108
(http://www.isical.ac.in)

Director's Report

It is my proud privilege to present the Annual Report of the Institute for the year 2010-2011 which happens to be the first one after I assumed the charge of the Director of the Institute.

Like earlier occasions, the Institute is proud for its very talented faculty members who have earned honours and awards during the period. A partial list of these is as follows:-

Professor Bidyut B. Chowdhuri of Computer Vision & Pattern Recognition Unit has received the prestigious J.C. Bose Fellowship Award from the Department of Science & Technology, Govt. of India. Professor Sanghamitra Bandyopadhyay of Machine Intelligence Unit has received the Shanti Swarup Bhatnagar Prize in Engineering Science. Professor Bandyopadhyay has also been elected Fellow of the National Academy of Sciences, Allahabad. Professor Nikhil R. Pal of Electronics & Communication Sciences Unit has been elected Fellow of the Indian National Science Academy. Professor Ashis SenGupta of Applied Statistics Unit has been elected Fellow of the National Academy of Sciences, Allahabad. Professor SenGupta has also been elected as President of the Mathematical Sciences Sections of the Indian Science Congress Association for 2011-2012. Dr. Abhiroop Mukhopadhyay of Planning Unit, Delhi Centre has received Sir Ratan Tata Senior Fellowship from the Institute of Economic Growth. Dr. Supratik Pal of Physics & Applied Mathematics Unit has received Alexander Von Humboldt Fellowship from Alexander Von Humboldt Foundation, Germany.

The Institute celebrated the 1st World Statistics Day on 20 October, 2010 in ISI, Kolkata. Professor Stephen M. Stigler, Ernest DeWitt Burton, Distinguished Service Professor, University of Chicago delivered the speech on this occasion.

To fulfil the objectives of the Institute, an Industry-Academia-Government Meet followed by an interactive session was held in the Institute on 12 September, 2010. Many heads of the leading institutions/organisations of the country participated in the session. Shri Pranab Mukherjee, Chairman, ISI Council and Hon'ble Finance Minister, Government of India chaired the session. Dr. V.K. Saraswat, Scientific Adviser to Defence Minister and Secretary DR&DS, Govt. of India, New Delhi; Dr. Debesh K. Das, Minister in Charge, Information Technology, Govt. of West Bengal; Prof. R. Balasubramanian, Director, Institute of Mathematical Sciences, Chennai; Prof. C.S. Seshadri, Director, Chennai Mathematical Institute, Chennai; Admiral A.K. Bahl, Director General, WESEE (Indian Navy), New Delhi; Mr. Peeyush Ranjan, Head, R&D, Google India, Bangalore; Mr. Srinath Batni, Director and Head, Infosys Technologies Ltd., Bangalore; Mr. Arun Mishra, Principal Executive Officer, Tata Steel Ltd., Jamshedpur; Dr. Gautam Samanta, Dr. Reddy's Laboratories Ltd., Hyderabad; Dr. Manish Gupta, Director, IBM Research-India/South Asia, New Delhi; Dr. Pradip K. Dutta, Corporate Vice President & Managing Director, Synopsys (India) Pvt. Ltd., Bangalore; Mr. Eugen Welte, CEO, Airbus Engineering Center India, Bangalore; Dr. Jaijit Bhattacharya, Director, Hewlett Packard India, Gurgaon; Mr. Alo Ghosh, President, Techna; Mr. George Thomas, Chief General Manager, Tata Motors Ltd.; Mr. S.A. Bhogle, Country Manager, Teoco; Dr. P.K. Saxena, Director, SAG, DRDO, Govt. of India; Captain Anand, Indian Navy, New Delhi were present and deliberated on this occasion.

The Institute organised the panel discussion on "Expectation of Future Leaders as a part of the "Integration 2011" programme on 15th January, 2011. Shri Pranab Mukherjee, Chairman, ISI Council and Hon'ble Finance Minister, Government of India chaired the panel discussion and Shri Harsha Bhogle, eminent sports commentator compared the programme among the speakers of the panel discussion, Shri Arun Shourie, Shri Sourav Ganguly, Shri Anupam Kher and Smt. Rita Bhimani were present.

An International Congress on "Productivity, Quality, Reliability, Optimisation and Modelling (ICPQROM 2011)" was organised by the SQC & OR Unit, Delhi in collaboration with Quality Council of India and DRDO during 07-08 February, 2011. Dr. Monmohan Singh, Hon'ble Prime Minister of India inaugurated the International Congress in the presence of Shri Pranab Mukherjee, Hon'ble Finance

Minister, Government of India and Chairman, ISI Council on 7th February, 2011 held at DRDO Bhawan, New Delhi.

The 45th Convocation of the Institute was held on 4th February, 2011 at Amrakunja of the Institute. Professor Sastry G. Pantula, Director, Mathematical Sciences Division, National Science Foundation, USA was present as the Chief Guest and delivered the Convocation Address. Professor M.G.K. Menon, FRS, President of the Institute and Shri Pranab Mukherjee, Chairman, ISI Council and Hon'ble Finance Minister, Government of India were also present on this occasion.

The International Statistical Education Centre, run by the Institute under the auspices of Government of India, celebrated its Diamond Jubilee in befitting manner during the period. In this connection, two International Conferences were held in Kolkata and Delhi during 04 – 05 February, 2011 and 11-12 February, 2011 respectively. Professor M.G.K. Menon, President, Indian Statistical Institute inaugurated the conference while Professor S.K. Das, Director General, Central Statistical Organisation, Ministry of Statistics & P.I., Government of India and Professor Sastry G. Pantula, Director, Mathematical Sciences Division, National Science Foundation, USA were present as the Chief Guest and Guest of Honour respectively at the Diamond Jubilee Celebration of ISEC at Kolkata. Shri Montek Singh Ahluwalia, Deputy Chairman, Planning Commission, Government of India delivered the key note address on this occasion. Dr. M.S. Gill, Hon'ble Union Minister for Statistics and Programme Implementation inaugurated the ISEC Diamond Jubilee Conference on "Statistics, Economic Development and Public Administration" on 11th February, 2011 at the Vasuki Auditorium, Lok Kala Manch, New Delhi. Dr. Pronab Sen, Pricipal Adviser, Planning Commission, Government of India and Dr. T.C.A. Anant, Chief Statistician & Secretary, Ministry of Statistics & P.I., Government of India were also present as the Guests of Honour and delivered their respective speech.

The Convocation of the International Statistical Education Centre (ISEC) was held on 29th March, 2011 at the Geology Auditorium of the Institute. Shri S.K. Das, Director General, Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India delivered the Convocation Address while Dr. Asit Chakraborty, Adviser, Reserve Bank of India, Mumbai was present as the Chief Guest.

A Memorandum of Collaboration (MOC) on Academic and Research Collaboration Programme was signed between the Defence Research and Development Organization (DRDO) and the Indian Statistical Institute (ISI). DRDO will provide a grant-in-aid Rs.10 Crores (approx.) to ISI for five years to promote academic and research activities. The Institute has signed Memorandum of Understanding with TEOCO, Kolkata; University of Singapore, Carleton University, Maastricht University, Holland and other Universities/Institutions/Organizations for development of research, academic and technological fields.

An Agreement was signed between the International Growth Centre (IGC) of London School of Economics & Political Science and the Indian Statistical Institute (ISI) to promote sustainable growth in developing countries by providing demand-led policy advice based on frontier research on 1st November, 2010 in London. Finance Director, London School of Economics and the Director, Indian Statistical Institute officially signed the Agreement for the respective Institution. Shri Pranab Mukherjee, Chairman of ISI Council and Hon'ble Finance Minister, Government of India formally declared the same on 5th December, 2010 at an Institute's function held in Kolkata.

The fourth Centre of the Indian Statistical Institute is going to be set up in Tezpur, Assam. Initially the Centre will start its Post-Graduate Diploma course on Statistical Methods with Applications from Tezpur University, Assam in July, 2011. In this regard a Memorandum of Agreement (MoA) was signed between the Indian Statistical Institute (ISI) and the Tezpur University in a function held on 05 December, 2010 in ISI, Kolkata in presence of Shri Pranab Mukherjee, Chairman of ISI Council and Hon'ble Finance Minister, Government of India and Professor Mihir K. Choudhury, Vice-Chancellor, Tezpur University, Assam. It is my great pleasure to inform you that the Government of Assam has

allotted a plot of land to the Institute measuring 75 Bigha 3 Katha near the Tezpur University. The Chennai Centre of the Institute will start a 2-year M.Stat. programme from July, 2011. The Institute has requested for a plot of land to the Government of Tamil Nadu for setting up the permanent campus in the vicinity of the Chennai city. The Institute has also requested the Government of West Bengal to allot some land adjacent to the area where National Institute of Biomedical Genomics (NIBMG) is being established in Kalyani to expand ISI's academic and research activities. A Committee has been set up to examine the future plan of academic, research and administrative activities of the Giridih Branch of the Institute.

The Institute undertook a large number of externally funded projects over the years. At present there are about 65 externally funded projects in the Institute. Major funding agencies of the projects mainly are Government of India, DST, CSIR, MIT, DRDO, ISRO, ICAR, ICMR, NAIP, US-Army, NIH (USA), NHF (Netherlands), LSE (London) etc.

The construction of Platinum Jubilee ISEC Building is nearing completion while the construction of boundary wall in the permanent North-East Centre of the Institute at Tezpur, Assam have been started and construction of the boundary wall in Giridih Branch, Jharkhand will start soon.

I am grateful to Professor M.G.K. Menon, President of the Institute and Shri Pranab Mukherjee, Chairman of ISI Council and Hon'ble Finance Minister, Government of India for their kind cooperation, help and guidance. I am also grateful to all the Council members, Dr. T.C.A. Anant, Secretary, Ministry of Statistics and Programme Implementation, Government of India and all other officers of the Administrative Ministry for their kind cooperation and advice. I also thankful to all the office bearers and all the workers of the Institute for their cooperation in their respective domains of activities.

March, 31, 2011 Bimal K. Roy

Seminar on the "Thought of Dr. B. R. Ambedkar" on the occasion of 119th Birth Anniversary of Dr. B. R. Ambedkar on 15.2.2011

"Regional Student Convention 2011" held on 25.2.2011 at Platinum Jubilee Building of the Institute

A performance by Smt. Swagatalakshmi Dasgupta, an eminent Rabindra Sangeet Singer in a Cultural Event held on 4.3.2011

Professor B. B. Bhattacharya delivering his speech in the Workshop on Computational Intelligence in Brain-Computer Interface and Context-Award Service Management held on 14.3.2011

Inter-University Football Match organized by the Institute on 23.3.2011

"Professor J. Roy Memorial Workshop" organized by ASU on 31.3.2011

Hindi Workshop organized by the Institute on 30.6.2010

Seminar organized by Center for Soft Computing Research : A National Facility on 6.7.2010

57th and 58th Annual Social Function of Indian Statistical Institute Club held on 22.7.2010

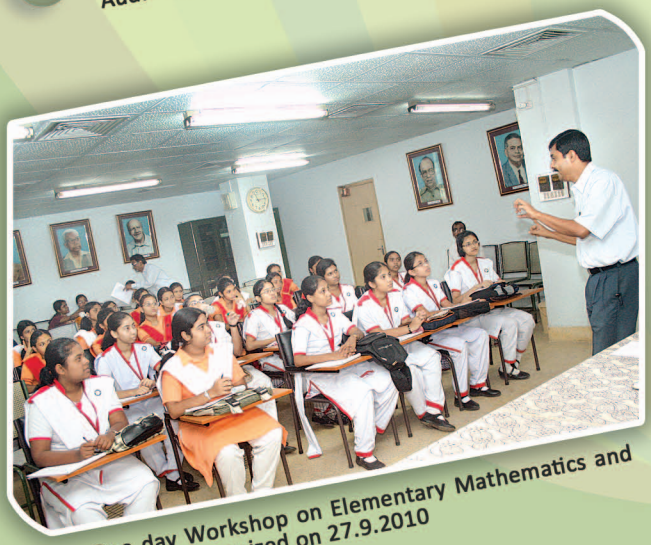
57th and 58th ISI Annual Social Function held on 22.7.2010 organised by ISI Club

Drama at the 57th and 58th ISI Annual Social Function organised by ISI Club on 22.7.2010

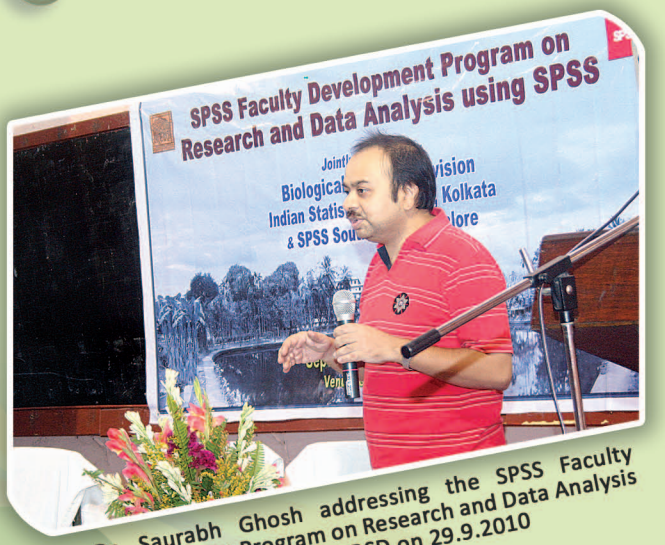
Felicitation to Shri Monomoy Bhattacharya, an eminent singer, on the occasion of 57th and 58th Annual Social Function of ISI Club held on 23.7.2010

Professor Bimal K. Roy, Director of the Institute addressing the ISI Staff on 5.8.2010 at the Geology Auditorium

Book exhibition of ISI, Bangalore Centre held on 21.8.2010



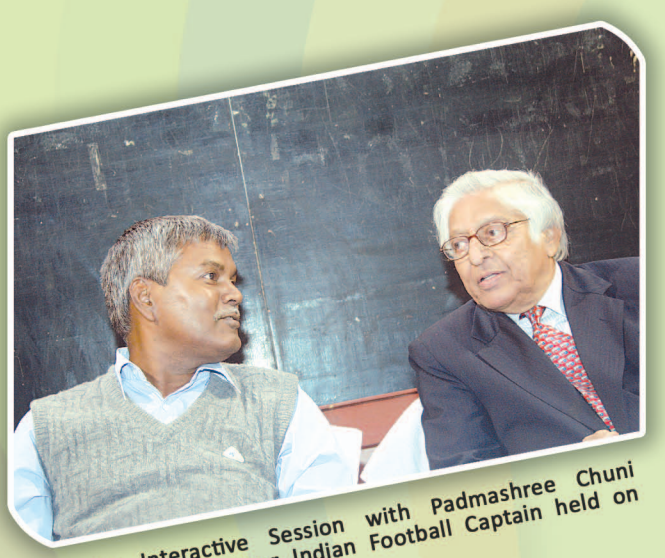
One day Workshop on Elementary Mathematics and Statistics organized on 27.9.2010



Dr. Saurabh Ghosh addressing the SPSS Faculty Development Program on Research and Data Analysis using SPSS organized by BSD on 29.9.2010

Estimation of Technical Manpower Requirement in West Bengal through Effective Means for Improving Quality of Training of Technicians held on 8.10.2010

Inaugural Ceremony of the International Conference on Frontiers in Handwriting Recognition held by C VPRU held at ITC Fortune Park, Kolkata on 16.11.2010



An Interactive Session with Padmashree Chuni Goswami, former Indian Football Captain held on 21.12.2010

Professor Abhijit Sen speaking at the National Seminar on "Dalit Households in Village Economics" on 7.1.2011

Dr. Debiprasad Duari delivering his speech during the Workshop and Exhibition on Astronomy and Astrophysics Concepts and Challenges held on 2.2.2011

Dr. Montek Singh Ahluwalia, Deputy Chairman, Planning Commission, Government of India delivering the keynote address at the ISEC Diamond Jubilee Celebration held on 4.2.2011

A Workshop on Reliability organized by SQC & OR Unit on 9.2.2011

ISI Annual Sports organized by ISI Club on 11.2.2011

A BRIEF HISTORY OF THE INSTITUTE

In the 1920's, Prasanta Chandra Mahalanobis, then a Professor at Presidency College, Calcutta conducted several studies employing statistical methods with results that vindicated his ideas about the efficacy and possibilities of the emerging science of Statistics. In a meeting on 17th December 1931 presided by Sir R. N. Mukherjee, the first President of the Institute, the Indian Statistical Institute (ISI) was formally established and Prasanta Chandra Mahalanobis was appointed the honorary Secretary. The Indian Statistical Institute was registered on 28th April, 1932, as a non-government and non-profit distributing learned society under the Societies' Registration Act No. XXI of 1860. The Institute is now registered under the West Bengal Societies Registration Act XXVI of 1961, amended in 1964. It has the following objectives:

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(i) To promote the study and dissemination of knowledge of Statistics, to develop statistical theory and methods, and their use in research and practical applications generally, with special reference to problems of planning for national development and social welfare;

(ii) To undertake research in various fields of natural and social sciences with a view to the mutual development of Statistics and these sciences;

(iii) To provide for, and undertake, the collection of information, investigations, projects, and operational research for purposes of planning and the improvement of efficiency of management and production.

(iv) To undertake any other ancillary activities in fulfillment of the objectives (i), (ii) and (iii).

The Institute started functioning initially from a room of the Presidency College with enduring support from a number of distinguished personalities and devoted scholars in Kolkata. Over the first two decades, which turned out to be a glorious chapter in the annals of Indian science and institution building, the ISI embarked upon a series of pioneering programmes involving the application of Statistics in search of solution of the urgent and live problems of the country. Such programmes included innovative projects on sample surveys of yield and land utilisation of crops, socio-economic after-effects of Bengal famine and problems of flood research. These innovations and methodological research have since become classics in Statistics. At the same time, the training of scientific personnel began to grow. This also encouraged high level research and brought into focus the need for publication of the research results, for which *Sankhyā* , the first international journal of the country in Statistics, came into being in 1933.

Apart from the impact made in the world of Statistics, earning for the Institute the patronage of Sir Ronald A. Fisher, the brilliant choice of the area of surveys, their social and national relevance held secured the Institute to a pivotal place in the task of nation-building when India became independent. Led by Professor Mahalanobis and a very able group of younger statisticians including R.C. Bose, S. N. Roy and C. R. Rao, the Institute was poised to take on the larger role. The institute is proud to have C.R. Rao, who is among the world leaders in statistical science over the last six decades and still active at the age of 88 as the Director of the Center for Multivariate Analysis at Pennsylvania State University, USA, in its list of alumni.

The 1950s saw the Institute establishing (i) a full fledged research and training school in Statistics and Probability, with its application in natural and social sciences, (ii) a planning wing entrusted with the formulation of the Second Five-Year Plan of India, (iii) publication of Sankhya, (iv) the National Sample Survey wing engaging in comprehensive socio-economic data collection for the nation, (v) a string of Statistical Quality Control units for promoting the quality movement at various industrial centres in the country, (vi) a collaboration with the International Statistical Institute to train Government statisticians from Asia and Africa, and (vii) an Electronic Computer Laboratory that was responsible for developing (a) the 1st mechanical hand computing machine, (b) the 1st Analog computer, (c) the 1st Punched Card storing machine and (d) the 1st Solid State Computer in India, to name some of the principal activities. In 1954 Pandit Jawaharlal Nehru, the then Prime Minister of India, entrusted Professor Mahalanobis and ISI with the responsibility of preparing the draft Second Five-Year Plan for the country. The draft submitted by Prasanta Chandra Mahalanobis and the planning models formulated by him and his colleagues have since been regarded as major contributions to economic planning in India. In 1956, the Institute installed the first electronic computer in the country. In 1961, the ISI, in collaboration with Jadavpur University, undertook the design, development and fabrication of a fully transistorized digital computer, called ISI-JU-1, which was commissioned in 1966. The Institute, from its formative period till present times, received as guests eminent scientists, some of whom were Nobel Laureates. Besides Ronald A. Fisher, J.B.S. Haldane and Walter A. Shewhart, the luminaries included Frederic and Irene Curie, Neils Bohr, A.N. Kolmogorov, P.M.S. Blackett, J.D. Bernal, Joan Robinson and Genedi Taguchi. In recent times, the visit of Amartya K. Sen, Robert Aumann, Lotfi A. Zadeh and S.R.S. Varadhan, 2007 Abel Prize winner for his contributions to probability theory and an alumnus of the institute, may be specially mentioned.

The formal recognition came in December 1959, when Pandit Jawaharlal Nehru piloted in the Parliament the enactment of the Indian Statistical Institute Act of 1959, which designated ISI as an 'Institution of national importance'. The activities steadily grew, existing interests became more broad-based and a number of science units were created in the interest of live interaction between Statistics and Natural and Social Sciences. Empowered by the Act to award degrees, the Institute started the B.Stat. and M.Stat. courses. An excellent library was founded at Kolkata and the Documentation Research and Training Centre began functioning in Bangalore. Other developments in infrastructure also began.

During 1971-72, two decisions of the Government of India produced serious repercussions on the functioning of the ISI. One was de-linking of the Institute from the Perspective Planning Division of the Planning Commission in 1971, while the other was the separation of National Sample Survey from the ISI and its take-over by the Central Government in 1972. Professor Mahalanobis passed away on 28th June, 1972. It was a critical period for the Institute. To overcome the problem, the ISI sought to strike a judicious balance between the individual academic work on truly fundamental problems and the work that called for a greater engagement with the social and economic problems of the country. The members of the Institute, under the Chairmanship of Shri P. N. Haksar, held a Special General Body Meeting on 26th July, 1974 and amended the Memorandum of Association and the Regulations of the Institute, encouraging more inter-disciplinary research and enhancing active participation of the scientists of the ISI in decision-making process of the Institute. The organisational amendments were implemented, with the concurrence of Government of India, in August, 1976. The various research units in natural, social and computer sciences were grouped under a number of scientific Divisions.

Over the next two decades diversity in research thrusts began to grow manifold, with emphasis on Computer Science and application of Statistics in the new areas of research in natural and social sciences. Two centres, one at Delhi and one at Bangalore were created with full-fledged research and teaching programmes. The Delhi Centre, initially housed within the Planning Commission premises, was started in 1974, and shifted to its present campus in 1975. The Bangalore Centre was conceived by Prof. P. C. Mahalanobis during 1960s. With the Statistical Quality Control unit functioning in Bangalore from 1956, and Documentation Research and training Centre from 1962, Professor Mahalanobis thought of starting a centre of ISI around the mid-sixties. However, the activities of the

Bangalore Centre started in September 1978 in a rented building under the Directorship of Professor G. Kallianpur. The various units moved to the present campus in May 1985 and in September 1996, the Bangalore Centre was formally declared as a Centre of ISI. The newly created Chennai centre of the Institute, which came into being on 26th July, 2008, is also expected to focus on such diversity of research. At present the Institute is fully funded by the Ministry of Statistics and Programme Implementation, Government of India. The support and encouragement of the Ministry are among the major factors which helped the Institute to sustain its excellence.

The present structure of eight divisions has been arrived at through some further changes. Recently there have been some changes. Systems Science and Informatics Unit (SSIU) has been started as a part of the Computer and Communication Sciences Division (CCSD) at ISI Bangalore centre in August 2009. The Documentation Research and Training Centre (DRTC) has been made a part of CCSD. The Indian Statistical Institute Act of 1959 was amended by the Parliament in 1995 to empower the Institute to award degrees/Diplomas not only in Statistics, but also in Mathematics, Quantitative Economics, Computer Science and such other subjects related to Statistics as may be determined by the Institute from time to time. Several new courses have also been added since: M. Tech. in Computer Science, M.Tech. in Quality, Reliability and Operations Research, M.S. in Quantitative Economics, B. Math. and M. Math.

In conclusion, a list of the distinguished scientists and statesmen who have served the Institute during the 79 years of its existence in the capacities of President, Chairman or Director is presented. A list of recipients of the honorary D.Sc. degree given by the Institute is also provided.

Presidents of the Institute

1	Sir Rajendra Nath Mookerjee	1932-35
2	Shri E. C. Benthall	1936-37
3	Shri James Reid-Kay	1938
4	Shri Badridas Goenka	1939-41
5	Dr. Nalini Ranjan Sarkar	1942-43
6	Dr. Chintaman D. Deshmukh	1944-1963
7	Shri Y. B. Chavan	1964-66
8	Prof. Satyendra Nath Bose	1967-75
9	Shri Subimal Dutt	1976-89
10	Prof. M.G.K. Menon	1990-till date

Chairmen of the Institute

1	Shri B. Rama Rao	1954
2	Shri D. N. Mitra	1955-63
3	Shri K. P. S. Menon	1964-70
4	Shri S. C. Roy	1971
5	Dr. Atma Ram	1972
6	Shri. P. N. Haksar	1973-97
7	Dr. Bimal Jalan	1998-2001
8	Dr. N. R. Madhava Menon	2002-03
9	Shri Pranab Mukherjee	2004-till date

Directors of the Institute

1	Prof. P. C. Mahalanobis	Dec	1931	-	June	1972
2	Prof. C. R. Rao	July	1972	-	June	1976
3	Prof. G. Kallianpur	July	1976	-	Sept	1978
4	Prof. B. P. Adhikari	Aug	1979	-	Oct	1983
5	Prof. Ashok Maitra	April	1984	-	Jan	1987
6	Prof. J. K. Ghosh	Jan	1987	-	Jan	1992
7	Prof. B. L. S. Prakasa Rao	Jun	1992	-	Feb	1995
8	Prof. S. B. Rao	July	1995	-	July	2000
9	Prof. K. B. Sinha	Aug	2000	-	July	2005
10	Prof. S. K. Pal	Aug	2005	-	July	2010
11	Prof. Bimal K. Roy	Aug	2010	-	till date	

List of persons awarded the D.Sc. (Honoris Causa) by the Institute

February 1962	Prof. Satyendra Nath Bose, Prof. Ronald A. Fisher, Pandit Jawaharlal Nehru, Dr. Walter A. Shewhart
April 1962	Prof. A. N. Kolmogorov
May 1965	Dr. Chintaman Dwarkanath Deshmukh
December 1974	Prof. Raj Chandra Bose, Dr. M. V. Keldysh, Prof. Jerzy Neyman
February 1977	Prof. Harald Cramer
February 1978	Shri Morarji Desai, Prof. L. V. Kantorovich
December 1989	Prof. C. R. Rao
January 2001	Prof. Gopinath Kallianpur
February 2004	Prof. S. R. Srinivasa Varadhan
March 2006	Prof. L. A. Zadeh
December 2006	Dr. Manmohan Singh
February 2011	Dr. Subhas Mukherjee (Posthumously)

1. TEACHING AND TRAINING

A brief account of teaching and training activities of the Teaching and Training Division during the academic session 2010-2011 is given below.

Degree, Associateship and Training Courses

During the academic session **2010-2011,** a total of **10137** candidates applied for admission and were called for written selection tests for various courses offered by the Institute, viz., B. Stat. (Hons.), B. Math. (Hons.), M. Stat., M. Math., Master of Science (M.S.) in Quantitative Economics, M.S. in Library and Information Science, M. Tech. in Computer Science, M. Tech. in Quality, Reliability and Operations Research, **Research Fellowships** in Statistics, Mathematics, Quantitative Economics, Computer Science, Quality, Reliability and Operations Research, Biological Anthropology, Physics and Applied Mathematics, Agriculture & Ecology, Sociology, Geology, Psychology, and Library and Information Science. Admission tests were conducted at **22** different centres all over the country. A total of **7603** candidates finally appeared for admission tests and a total of **600** candidates qualified in the written tests, and were called for interviews. Based on the performance in the written tests, interview and the academic records, **260** candidates were offered admission to various courses during the academic session under review.

The annual examinations for all the regular courses during 2009-2010 academic session were held during May 2010. The 2010-11 academic session commenced from **July, 2010**.

The number of candidates admitted to the different degree programmes and in Junior Research Fellowship during 2010-2011 and the number of students who passed the annual examinations in 2010, are given in **Table 1**.

Till **31st March, 2011, 252** trainees of Engineering and Technology courses from various Universities/Institutions (Academy of Technology - Hooghly, B. P. Poddar Institute of Management and Technology, Banaras Hindu University, Bankura Unnayani Institute of Engineering, Bengal College of Engineering & Technology, Bengal Engineering & Science University- Shibpur, Bengal Institute of Technology, Birla Institute of Technology & Science – Pilani, Birla Institute of Technology – Jharkhand, Birla Institute of Technology – Mesra, Bostan College for Professionals Studies – Gwalior, Calcutta Institute of Technology, Camellia Institute of Technology, Camelia School of Engineering & Technology, Chennai Mathematical Institute, Department of Microbiology – Asutosh College, Dr. B. C. Roy Engineering College – Durgapur, Dumkal Institute of Engineering & Technology, Durgapur Institute of Advanced Technology & Management, Future Institute of Engineering & Management – Kolkata, Government College of Engineering & Leather Technology, Guru Nanak Institute of Technology, Haldia Institute of Technology, Heritage Institute of Technology, IERCEM Institute of Information Technology, Indian Institute of Information Technology & Management – Gwalior, Indian Institute of Science Education & Research – Pune, Indian Institute of Technology – Bombay, Indian Institute of Technology – Delhi, Indian Institute of Technology – Guwahati, Indian Institute of Technology - Kharagpur, Indian Institute of Technology - Roorkee, Indian School of Mines University - Dhanbad, Indian School of Mines - Dhanbad, Institute of Engineering & Management - Salt Lake, Institute of Radio Physics & Electronics, Jadavpur University, Kalinga Institute of Industrial Technology, Kalyani Government Engineering College, Kalyani University, L.N.M.I.I.T. – Jaipur, Meghnad Saha Institute of Technology, Modi Institute of Technology & Science, Narula Institute of Technology, National Institute of Technology - Durgapur, National Institute of Technology – Rourkela, National Institute of Technology- Tiruchirapalli, Netaji Subhas Engineering College, North Bengal University, Peelamedu Sambakulam Govindasamy Tech, RCC Institute of Information Technology, Ramakrishna Misson Vidyamandir - Belur Math, Seacom Engineering College, Shanmugha Arts, Science, Technology & Research Academy, Shri Rama Krishna College of Commerce & Science – Rewa, Sikkim-Manipal Institute of Technology, SRM University – Tamilnadu, Symbiosis Centre for Management and Human Resource Development, Techno India, University of Calcutta, University of

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Hyderabad, Vidyasagar University – Midnapore, Visva Bharati – Santiniketan, West Bengal University of Technology – Salt Lake) received two weeks/six weeks/two months/three months/four months and six months Project training in different Units of the Institute, viz., ACMU, AERU, ASU, BAU, CSSC, CVPRU, DEAN'S OFFICE, ECSU, ERU, GSU, MIU, PAMU, PRU and SQC & OR under the guidance of different faculty of the Institute.

Convocation

The **45th Convocation** of the Indian Statistical Institute was held on **04th February, 2011, at 4.30 P.M.** It was started with Vedic Hymn by ISI Club, followed by a welcome address by Prof. M.G.K. Menon, President, ISI, annual review by Prof. Bimal K. Roy, Director, ISI, and Chairman's Address by Shri Pranab Mukherjee, Hon'ble Finance Minister, Govt. of India & Chairman of ISI Council. The degrees were awarded to students by Prof. M.G.K. Menon. The medals to the recipients were awarded by Shri Pranab Mukherjee. This was followed by a Convocation Address by Professor Sastry G. Pantula, Director, Mathematical Sciences, NSF, USA. The Convocation was closed by Prof. M.G.K. Menon, President, ISI, after a vote of thanks by Prof. B. P. Sinha, Dean of Studies, ISI, and the National Anthem by ISI Club.

The Gold Medal for ***Mahalanobis International Symposium on Statistics*** for ***M. Stat*** students was given to:

Sayan Banerjee

ISI Alumni Association ***Mrs. M.R. Iyer Memorial Medals*** for outstanding performances were given to:

***B. Stat. (Hons.)*:** Sujayam Saha ***M. Stat.*:** Sanchayan Sen

***M. Tech. (QR & OR)*:** Arindam Chakraborty

ISI Alumni Association ***Rashi Ray Memorial Medals*** for outstanding performance in ***M. Tech. (CS)*** was given to:

Kaushik Sarkar

ISI Alumni Association ***P.C. Panesar Gold Medal*** for outstanding performance in ***M. Math.*** was given to:

Sagnik Chakraborty

Sabyasachi Roy Memorial Gold Medal for the best project work in second year of ***M. Stat.*** Programme:

Pratyaydipta Rudra

Nikhilesh Bhattacharya Memorial *Gold Medal* for the best student in ***B. Stat. (Hons.)*** was given to:

Sujayam Saha

Table 1

Number of students passed during 2010 and number of existing students/fellows during 2010-2011.

Sl. No.	Courses		Number of Students	
			Passed in the Annual Exam. in 2010	During the year 2010-11
01.	**B.Stat. (Hons.)**	1st year 2nd year 3rd year	32 43 09	36 31 41
02.	**B.Math. (Hons.)**	1st year 2nd year 3rd year	14 02 11	29 14 02
03.	**M.Math.**	1st year 2nd year	08 06	07 08
04.	**M.Stat.**	1st year 2nd year	44 54	17 44 **
05.	**M.Stat. (Applications)**	1st year 2nd year	15 -	- 15
06.	**M.S. (QE)**	1st year 2nd year	27*(14+13) 39*(22+17)	32*(11+21) 28*(15**+13)
07.	**M.Tech. (CS)**	1st year 2nd year	21 15	07 19
08.	**M.Tech. (QROR)**	1st year 2nd year	10 04	12 10
09.	**M.S. (Library & Information Science)**	1st year 2nd year	06 07	06 06
10.	**Junior & Senior Research fellows & Research Associates**		11	172
Grand Total			**378**	**536**

***** Total number, including Kolkata and Delhi.

Table 2

Ph.D. Degree awarded by the Institute in the 45th Convocation held on 4th February, 2011

Sl. No	Name of the Fellow	Title of the Thesis	Subject	University /Institute	Name of the Supervisor(s)
1.	Pritha Banerjee, M.C.S. (University of Pune)	Fast Placement and Floor planning Methods for Modern Reconfigurable FPGAs.	Computer Science	ISI	Prof. Susmita Sur-Kolay, ACMU, ISI, Kolkata
2.	Anup Kumar Bhandari , M. Sc. (Vidyasagar University)	Selected Aspects of Performance of Indian Industries: An Empirical Investigation.	Quantitative Economics	ISI	Prof. Pradip Maiti, ERU, ISI, Kolkata

Teaching and Training

3.	Rudrani Bhattacharya, M. A. (J.N. University)	Public policy, long run growth and Economic transition from Agriculture to Industrial mass production.	Quantitative Economics	ISI	Prof. Satya P. Das, Planning Unit, ISI, Delhi
4.	Somnath Chattopadhyay, M. Sc. (University of Calcutta)	Analysis of Poverty in Rural West Bengal.	Quantitative Economics	ISI	Prof. Amita Majumder, ERU, ISI, Kolkata
5.	Prosenjit Das, M. Sc. (Burdwan University)	A study on Algebras with retractions and on planes over a DVR.	Mathematics	ISI	Prof. Amartya Dutta, SMU, ISI, Kolkata
6.	Abhijit Mandal, M. Stat. (Indian Statistical Institute)	Minimum Disparity Inference: Strategies for Improvement in Efficiency.	Statistics	ISI	Prof. Ayanendranath Basu, BIRU, ISI, Kolkata
7.	Goutam Pal, M. Stat. (Indian Statistical Institute)	Sequences of positive integers containing no k-term arithmetic progressions and smooth numbers in short intervals.	Mathematics	ISI	Prof. Gadadhar Misra, I.I.Sc., Bangalore
8.	Sahana Roy Chowdhury, M.S. (Q.E.) (Indian Statistical Institute)	Wealth Inequality and Economic Performances.	Quantitative Economics	ISI	Prof. Abhirup Sarkar, ERU, ISI, Kolkata
9.	Sriparna Saha, M. Tech. (C.S.) (Indian Statistical Institute)	Single and multiobjective approaches to clustering with point symmetry.	Computer Science	ISI	Prof. Sanghamitra Bandyopadhyay, MIU, ISI, Kolkata
10.	Arindam Biswas M. Tech. (C.S.) (Indian Statistical Institute)	Geometric Characterzation of Digital Objects: Algorithms and Applications to Image Analysis.	Computer Science	ISI	Prof. B. B. Bhattacharya, ACMU, ISI, Kolkata
11.	Suhas Jaykumar Pandit	Intersection numbers, Embedded spheres and Geosphere laminations for free groups.	Mathematics	ISI	Dr. Siddartha Gadgil, ISI, Bangalore

Table 3

Research Fellows of ISI who have been awarded Ph.D. degree by Academic Bodies other than ISI during 2010- 11 for work done in the ISI

Sl. No	Name of the Fellow	Title of the Thesis	University	Name of the Supervisor
1.	Subhendu Chakraborty	Non linear dynamics of nutrient-phytoplankton-zooplankton systems in the presence of toxin producing plankton.	Jadavpur University	Prof. Joydev Chattopadhyay, AERU, ISI
2.	Tanumi Kumar	Mycorrhizal status of some mangroves and their associates with special reference to soil characteristics of Sundarbans, West Bengal.	University of Calcutta	Prof. Manoranjan Ghose, AERU, ISI
3.	Aruna Meka	A Molecular Genetic Study of Couples with Recurrent Spontaneous Abortions.	Jadavpur University	Prof. B. M. Reddy, BAU, ISI
4.	Shailendra Kumar Mishra	Adolescent Reproductive Health: Bio-cultural Dimensions.	University of Calcutta	Dr. Susmita Mukhopadhyay, BAU, ISI
5.	Suvadip Paul	Dispersion Phenomena in Laminar and Turbulent Flows.	Jadavpur University	Prof. B. S. Mazumder, PAMU, ISI
6.	Arpita Ghosh	Study of Cavity Quantum Electrodynamics in both Fock Space and interacting Fock Space.	Jadavpur University	Prof. P. K. Das, PAMU, ISI
7.	Narayan Chandra Deb	Design and development of an Acoustic Sounder for Probing Antarctic Environment.	Jadavpur University	Dr. Srimanta Pal, (Co-Supervisor), ECSU, ISI
8.	Tandra Pal	Some Methodologies for Rule Based System Identification in a Computational Intelligence Framework.	Jadavpur University	Prof. Nikhil R. Pal, (Co-Supervisor), ECSU, ISI
9.	Partha Pratim Roy	Multi-oriented and Multi-scaled Text Character Analysis and Recognition in Graphical Documents and their Applications to Document Image Retrieval.	Universitat Autonoma de Barcelona, Spain	Dr. Umapada Pal (Co-Supervisor), CVPRU, ISI
10.	Ujjwal Bhattacharya	Some studies on recognition of handwritten characters of Bangla.	Jadavpur University	Prof. Swapan Kr. Parui, CVPRU, ISI

Number of candidates awarded degrees/ associatiships in the 45th Convocation of the Institute held on 4th February, 2011

	Degree / Associateship	Number of candidates
1.	Doctor of Science (D. Sc.)	01
2.	Doctor of Philosophy (Ph. D)	11
3.	Master of Technology (M. Tech.) in Computer Science	15
4.	Master of Technology (M. Tech.) in Quality, Reliability and Operations Research	04
5.	Master of Statistics (M. Stat.)	54
6.	Master of Mathematics (M. Math.)	06
7.	Master of Science (M.S.) in Quantitative Economics	39
8.	Master of Science (M.S.) in Library and Information Science	07
9.	Bachelor of Statistics (Honours) [B. Stat. (Hons.)]	09
10.	Bachelor of Mathematics (Honours) [B. Math. (Hons.)]	11
	Total	157

INTERNATIONAL STATISTICAL EDUCATION CENTRE (ISEC)

The international Statistical Education Centre (ISEC) was founded in 1950 at the initiative of Professor P. C. Mahalanobis through an agreement between the International Statistical Institute and the Indian Statistical Institute (ISI). At present, the Centre is run by the Indian Statistical Institute under the auspices of the Government of India. The centre functions under a joint Board of Directors. In its more than 60 years history, the board of Directors of ISEC has had only two chairmen. Professor P. C. Mahalanobis was the chairman since the inception of the centre in 1950 until his death in 1972. Since then, Professor C. R. Rao has been the Chairman of the Board.

The trainees were provided with computer facilities and internet connections in the ISEC PC room and in the ISEC hostel. They had access to the books of our ISI library. Teachers of the headquarters of the Indian Statistical Institute and officers of the Government of India participated in teaching the Regular Course during the year. All the trainees in the 64th term Regular Course have successfully completed the course and have been recommended for the award of Statistical Training Diploma by the Teacher's Committee. Till now, more than 1470 trainees from about 70 countries have received the Statistical Training Diploma.

Construction work has been ongoing for a finishing touch for a new, modern, international building for ISEC at the 202 B. T. Road campus of the Institute, which will include the ISEC hostel, class rooms, offices, etc. Professor Bimal. K. Roy, Director, ISI, has taken special interest in this project. Professor C. R. Rao and all other members of the Board of Directors have been very keen that the ISEC trainees enjoy a comfortable stay at ISI and get the best of facilities during their training. We hope that the completion of this building will provide a major facelift to the Centre and enhance its international image.

ISEC has completed 60 years in 2010. The Institute and the Centre has extensively celebrated the Diamond Jubilee with the help of following occurrences:

1. Two-day ISEC International Conference at Kolkata during 4-5 Feb.2011 on the theme of "Statistics, Science and Human Development".
2. Subsequently, we had a two-day International Level Conference at Delhi during Feb11-12, 2011 on the theme of "Statistics, Economic Development and Public Administration".
3. ISEC also organized a session at the 15th Meeting of Commonwealth Statisticians, which was held in Delhi during Feb7-10, 2011.
4. Exhibition on "Sixty years of ISEC" had been organized at Kolkata and Delhi at the times of the conferences.

We are very much indebted to the members of Board of Directors of ISEC, Professor C. R. Rao, Professor Bimal K. Roy, Professor J. K. Ghosh, Prof. T. C. Anant and Sri S. K. Das for their involvement, encouragement and guidance. Many senior Statisticians from outside the Institute and senior members of the Ministry of Statistics and Programme Implementation have served in different committees of the Centre and I express my thanks to them. I also thank the teachers of ISEC and workers of ISI who extended their help in successfully organizing the ISEC activities.

I thank all the former Member Secretaries including Professor Shibdas Bandyopadhyay, Professor A. B. Raha and Professor Monoranjan Pal, Professor A. N. Basu who continue to assist the centre with their experience. Professor P. Bharati, who shares a major load in connection with the administration of the Centre, also deserves special thanks.

I hope that the training received here will help the trainees to build a successful career in the future. I wish the best for them. Before I finish I would like to make this comment that this Diamond Jubilee Year will be best respected if we are able to begin a new episode of ISEC history by incorporating cross country inter-disciplinary teaching and research programmes, which will immensely benefit the vast unused human potentials in the developing countries of Asia, Africa, Pacific, Latin America and Europe.

2. RESEARCH AND OTHER SCIENTIFIC ACTIVITIES

The major thrust of the Institute is on research in various disciplines comprising Theoretical and Applied Statistics, Mathematics, Computer Sciences, Biological Sciences, Economics and other Social Sciences, Physics and Earth Sciences, Statistical Quality Control and Operations Research, and Library and Information Sciences. Scientists of the Institute carry out independent research in their own basic discipline and also undertake interdisciplinary research in collaboration with other units within the Institute and also with outside organizations. The Institute also takes up various internally and externally funded projects in diverse fields on challenging live problems of national and international importance. As a part of research activities, scientists of the Institute are involved in consultancy work as well. This section gives a brief account of the principal areas of work over the past year of the scientific divisions of the Institute, namely, the Divisions of:

Theoretical Statistics and Mathematics

Applied Statistics

Computer and Communication Sciences

Physics and Earth Sciences

Biological Sciences

Social Sciences

Statistical Quality Control and Operations Research

Library, Documentation and information Sciences

In addition, there is a report each from the 'Center for Soft Computing Research: A National Facility' and the 'Computer and Statistical Services Centre'.

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Research in Non-Commutative Geometry

Quantum isometry groups: It is proved that if a compact quantum group acts faithfully and `linearly' in a suitable sense on the homogeneous space G/T where G is a semisimple, compact, connected, centreless Lie group and T its maximal torus, then the quantum group must be commutative as a C* algebra, i.e. of the form C(K) for some compact group K.

Debashish Goswami

Exit time asymptotics for quantum Brownian motion: Some general results about exit time asymptotics of quantum Brownian motions on noncommutative homogeneous spaces have been obtained.

Biswarup Das and Debashish Goswami

Research in Cryptography

A generic construction of an Identity Based Signcryption Scheme is obtained. It is proved that if the underlying encryption and signature schemes are secure, then the signcryption obtained is also secure. It is also shown that by instantiating with some known signature and encryption schemes the resulting signcryption compares well with respect to efficiency with many efficient signcryption schemes.

Sumit Pandey and Rana Barua

The generic construction of the public key signcryption scheme due to An, Dodis and Rabin has been discussed from a different angle. It has been shown that by suitably modifying the construction, one can obtain an unforgeable signcryption scheme even when the underlying encryption scheme is taken to be secure in a weaker model.

Sumit Pandey and Rana Barua

Research in Algebraic Topology

Simplicial version of Bredon–Illman cohomology with equivariant local coefficients system is introduced and classified. Further, its relationship with simplicial equivariant twisted cohomology has been investigated. As an application, equivariant reduced power operations in simplicial Bredon-Illman cohomology with local cofficients system has been derived.

Goutam Mukherjee

Research in Probability Theory

It was shown how half independence arises in the context of spectral distribution of random matrices and the connection of this notion to product convolution was shown. An analgoue of the central limit theorem and of the Cramer's theorem was proved for half independent variables. The symmetrised Rayleigh distribution plays the same role as the normal distribution in this context.

Distributional convergence of the upper order extreme eigenvalues was established for several circulant type matrices. An interesting result on the tail behaviour of k-fold product of i.i.d. exponential variables was established for all positive integers k.

Arup Bose, Rajat Subhra Hazra and Koushik Saha

Detailed asymptotic properties of Pfiefer records were established.

Arup Bose and Sreela Gangopadhyay

Spectral limits of k-circulant matrices were obtained when the entries are heavy tailed.

Arup Bose, Rajat Subhra Hazra, Koushik Saha and Suman Guha

Limiting distribution of some band matrices were established where the amount of banding was assumed to be flexible.

Limiting spectral distribution was obtained for some balanced versions of the Toeplitz and Hankel matrices.

Arup Bose and Anirban Basak

Limiting spectral distrbution of random matrices was studied when the number of diagonals with possibly nonzero entries is finite. This provides some interesting insight into the Wigner law and also may lead to other interesting studies for such matrices.

Arup Bose and Sanchayan Sen

Siginifcant progress has been made on the study of the limiting spectrum of the sample variance covariance matrix for observations from a stationary time series.

Arup Bose, Anirban Basak and Sanchayan Sen

It was shown that suitable patterned matrices which are not the usual Wigner matrices also have the semicircle law as their limiting spectral distribution, thereby establishing the robustness of the limit to variations in the pattern.

Arup Bose and Sayan Bannerjee

A class of probability measures is constructed on the space of Lipschitz isometric maps of a compact 1-manifold in R^2.

Amites Dasgupta and Mahuya Datta

The concepts of wavelet and multiresolution analysis (MRA) have been extended to many different settings; for example, to locally compact abelian groups, p-adic groups, Riemannian manifolds, abstract Hilbert spaces, Lie groups, etc. We are trying to develop a wavelet theory for local fields of positive characteristic. A local field is a field with a topology under which it is locally compact, nondiscrete and totally disconnected. Using a prime element of a local field K of positive characteristic, the concepts of MRA and wavelet can be generalized to such a field.

A version of the splitting lemma is proved for this setup and using this lemma the wavelet packets associated with such MRAs are constructed. It has been showd that these wavelet packets generate an orthonormal basis of L^2(K) by translations only. An analogue of splitting lemma is proved for frames and the wavelet frame packets are constructed in this setting.

Biswaranjan Behera

Research in Commutative Algebra

In the study of affine fibrations and locally nilpotent derivations, one often encounters commutative R-algebras A which are obtained as the intersection of A[1/x] and A[1/y] where both A[1/x] and A[1/y] are polynomial algebras in one variable over R[1/x] and R[1/y] respectively. We call such an algebra as an A^1-patch. When R is the polynomial ring k[x,y] over a field k, a structure theorem has been obtained which describes and classifies all algebras which arise as A^1-patch over R by x and y.

Amartya Kumar Dutta, Neena Gupta and Nobuharu Onoda

Projective generation of curves: Let R be an affine domain of dimension n over an infinite field k and I\subset R[T] be an ideal of height n such that the conormal bundle of I is trivial. It is proved that there is a projective R[T]-module P of rank n mapping onto I provided the ideal I(0) satisfies some (necessary) condition on the Euler classes.

Mrinal K. Das and S. M. Bhatwadekar

On triviality of the Euler class group of a deleted neighbourhood of a smooth local scheme: Let (R_m) be a smooth local ring, which is localization of an affine domain at a smooth prime ideal. Let f \in m be a regular parameter. Let I be an ideal of R_f which is a local complete intersection. It is proved that in most of the cases I is a complete intersection. Further, the Euler class Group E(R_f) is trivial.

Revisiting Nori's question and homotopy invariance of Euler class groups: In this paper detailed investigation has been carried out on the relation between the Euler class group E(R) and the Euler class group E(R[X]), where R is a commutative Noetherian ring. A variant of Nori's "homotopy conjecture" is formulated and proved in the set up where the base ring is not smooth.

Mrinal K. Das

Research in Differential Topolgoy

Lagrangian Floer cohomology and Fukaya category of symplectic orbifolds has been studied. This is related to Homological Mirror Symmetry conjecture of M. Kontsevitch.

Mainak Poddar and C.H. Cho

Torus actions on orbifolds have been studied.

Mainak Poddar, Soumen Sarkar, Saibal Ganguli and S. Hu Wilfrid

Partial isometries of sub-Riemannian manifolds in Euclidean spaces have been studied following the theory of *h*-principle.

Mahuya Datta

Research in Harmonic Analysis

Characterized eigenfunctions of Laplace-Beltrami operators for certain amenable Lie groups.

Rudra P. Sarkar

Research in History of Mathematics

Narayana's treatment of Pell's equation and his applications has been examined in the framework of the theory of continued fractions.

Amartya Kumar Dutta

Stat-Math Unit, Delhi

Virus Spread on Finite Networks

In this work we consider a simple virus infection spread model on a finite population of *n* agents connected by some neighborhood structure. Given a (fixed or random) graph *G* on *n* vertices, we start with some set of initial infected vertices. At each discrete time step, an infected vertex tries to infect its neighbors with probability $\beta \in (0, 1)$ independently of others and then it dies out. The process continues till all infected vertices die out. This model was first introduced by Draif, Ganesh and Massoulié (2008). They obtained an upper bound using matrix based methods. We focus on obtaining a simple lower bound using breadth-first search algorithm of the expected number of ever infected vertices starting with one infected site. We show that in a variety of examples this lower bound gives better approximation than the upper bound derived by Draif, Ganesh and Massoulié (2008) and unlike the upper bound our lower bound works for all $\beta \in (0, 1)$. Moreover we prove that if the graph *G* "locally looks like a tree", in the sense of *local weak convergence*, then our lower bound is asymptotically exact. Finally we also provide a generalization of this bound when the virus spread starts with more than one infected vertex.

Antar Bandyopadhyay and Farkhondeh Sajadi

Standard Deviation Estimates for Tree Order Restricted Models

In this work we consider estimation of a common variance of several populations whose means are *tree ordered* restricted, that is, there is a "base" population with mean μ_0 and all other population has mean $\mu \leq \mu_0$. This kind of scenario is rather common in various sample surveys as well as in clinical trials. It is known that under this tree order restriction the least squared estimator of the mean vector is often biased. In fact the bias could be considerably big if a large number of populations are being considered. In this work we discuss the asymptotic properties of the least squared estimator of the common variance as the the number of populations tend to infinity. Various limit theorems are derived depending on the different growth rates of the sample sizes in comparison to the number of populations. In particular it is shown that in certain cases where the least square estimate of the unknown base mean μ_0 is highly biased the estimate of the common variance has good asymptotic properties such as consistency and asymptotic normality.

Antar Bandyopadhyay and Sanjay Chaudhuri

Greedy Algorithm for Mean-Field Traveling Salesman Problem

In this work we are considering the random traveling salesman problem (TSP) in the mean-field setup, that is, when the intercity distances are i.i.d. with some distribution *F*. In a recent work of Wästlund (2010) it has been derived rigorously that if *F* has a continuous density at *0* with *F(0) > 0*, then the objective function (the total length of an optimal tour) for this problem is asymptotically almost surely a constant. This was predicted by Meźard and Parisi (1986) using non-rigorous *cavity method*. In this work we consider the *greedy tour* which is to move to the nearest non-visited city and show that under the same conditions on *F* the objective function (the total length of the greedy tour) asymptotically almost surely scales as *log n*. A similar result is known in literature for Euclidean TSP and greedy tour. We further derive the limiting behavior of the total length of the greedy tour for all other *F* and show that its asymptotic properties are determined by the scaling properties of the density of *F* at *0*.

Antar Bandyopadhyay and Farkhondeh Sajadi

Generalized Preferential Attachment Random Graph Models

In this work we consider a non-classical preferential attachment model of generating a growing sequence of random graphs where we allow the n^{th} -vertex to connect to a_n vertices in *{1, 2, …, n-1 }*, where a_n can be fixed or random and may or may not depend on *n*. Using Athreya-Karlin embedding technique we prove several asymptotic results for this graph sequence. In particular this extends many of the known results in this domain.

Antar Bandyopadhyay and Krishna B. Athreya

Random Walks on I.I.D. Random Environment on Free Groups

In this on going work we consider the classical (static) RWRE model on a free group with finitely many generators where we assume the environment at each group element is independent and the joint law is invariant under the action of the group which makes it *i.i.d.*. We also assume that the environment is uniformly elliptic. We show that under some technical assumptions unless the group is **Z** the walk is always transient. This is in sharp contrast to the models described in Lynos and Pematle (1992) Moreover under same technical assumptions we derive the quenched SLLN and annealed and quenched CLTs for the distance of the particle from the starting point. We believe our results are true even without the technical assumption and a more detailed study is underway.

Antar Bandyopadhyay, Siva Athreya and Amites Dasgupta

Urn Model on Infinite Graphs

In this on going work we formulate completely new type of \emph{urn models} where the number of colors is countably infinite. We derive limiting shape results for certain transient and null-recurrent replacement matrices and show that for one dimensional integer line we get a normal limit for either cases. This is in sharp contrast to what is known in the case of (classical) urn models with only finitely many colors. We believe the shape results really depend on the qualitative geometric properties of the underlying graph structure (such as amenable or non-amenable) and not quite on the Markov chain properties of the replacement matrix (such as recurrence or transience). More detailed study is underway.

Antar Bandyopadhyay and Debleena Thacker

The work was continued on identities for the minors of the distance matrix, the Laplacian matrix and the resistence matrix of a graph.

R. B. Bapat

Matrix Analysis

The use of differential geometric techniques in matrix theory was developed further. The multivariable geometric mean of matrices was shown to be monotone. Applications of the concept in imaging, elasticity and quantum mechanics were explored.

Rajendra Bhatia

Work continued on the following problems. *Martingale Problems* - To find necessary and sufficient conditions for an operator to be a generator of a Markov process, *Stochastic Filtering Theory* To show uniqueness of solution for the filtering equations when the observation noise is an Ornstein-Ulhenbeck process, *Bioinformatics* Search for a algorithm to identify the intorn-exon boundaries statistically in a a DNA sequence.

Abhay G. Bhatt

The work on (1) Penalized regression techniques (with Prof. S. N. Lahiri), (2) Bootstrap of Lasso type estimations (with Prof. S. N. Lahiri), (3) Tests for stationarity of continuous time series and (4) Application of Lasso-type estimation in finite populations is being continued.

Arindam Chatterjee

Survival Analysis- continued with modelling of competing risks data arises from coal mills. Worked on bounds for coherent systems based on signatures. Studied discrete concepts of ageing and looking at tests for them.

Isha Dewan

Research interests has been in the areas of Diophantine equations and analysis, irreducibility of polynomials and prime numbers and cryptography.

There was some work done on some problems concerning Ramanujan primes and had a publication on that. The joint work (with K. Hare and T. Stoll) on some problems on binary digits of numbers was continued. The work (with T. N. Shorey independently and with S. K. Khanduja and Ramneek Kaur) was done and got some irreducibility criterion of a certain class of classical polynomials. The work is still being continued.

In a joint collaborative work with Ram Murty, Grimm's conjecture was studied and observed some connection of Grimm's Conjecture with smooth numbers. Also along with problems in my area, had been studying and looking into some literature and problems on automatic sequences.

Shanta Laishram

Non-linear Regression, Survival analysis.

Swagata Nandi

Earlier work on noncommutative geometry have been continued, in particular on the geometry of quantum groups and their homogeneous spaces.

Arup Kumar Pal

Probability, Random graphs, Statistical analysis of whole genome.

Rahul Roy

Probability, Random graphs, extreme value theory.

Anish Sarkar

Computational Biology, Statistical Computing

Deepayan Sarkar

Research Activities

The study on finite dimensional algebras and their automorphism groups (with my student) has been started. The work on the Kneser-Tits problem has been continued.

Maneesh Thakur

Stat-Math Unit, Bangalore

Primary field of interest has been in Probability theory. Work is going on with models that arose primarily in either statistical physics or population biology. Initially, the focus was on martingale problems connected with measure-valued branching processes. The tools involved were semi-linear partial differential equations, stochastic partial differential equations, and stochastic differential equations. Work is going on in models in Statistical Physics (Abelian Sandpile Model) and in Population Biology (Branching-Coalescing systems). Studies are going on in Brownian motion on real trees and Random walk in Random environments.

Siva Athreya

Factorial experiments: Main effect plans

Regarding factorial experiments, orthogonality is an extremely desirable property in terms of simplicity as well as precision. However, orthogonal plans often require large run size, particularly for asymmetrical experiments. Use of blocking often makes run size even larger. However, found situations when use of blocks have been helpful in finding an orthogonal MEP with small run size. Restricting to main effect plans (MEP), the concept of orthogonal "through the block factor" has been defined and constructed an infinite series of such plans with two and three-level factors, requiring a smaller run size than a usual OMEP. Attempts are being made to generalise this concept to plans estimating interactions.

Several series of "inter-class orthogonal" main effect plans (MEPs) have been constructed for asymmetrical experiments with small run size, deviating "as little as possible" from the desirable properties like orthogonality and/or equal replications.

Sunanda Bagchi

Extensions of Stinespring's Theorem

We strengthen Mohammad B. Asadi's analogue of Stinespring's theorem for certain maps on Hilbert C^C-modules. We also show that any two minimal Stinespring representations are unitarily equivalent. This is a joint work with G. Ramesh and K. Sumesh. This will appear in the Journal of Operator Theory.

Linear maps preserving Unitary conjugation

We characterize linear maps on von Neumann algebras which leave every unital subalgebra invariant. We use this characterization to determine linear maps which respect unitary conjugation, answering a question of M. S.Moslehian. This will appear in the Banach Journal of Mathematical Analysis.

B.V. Rajarama Bhat

Stochastic difference equation

The stochastic difference equation on a locally compact group G similar to the equation considered by Tsirelson and Yor on one-dimensional torus has been considered. The case of stationary noise is considered and proved that if G is a pointwise distal group and ϕ is a distal automorphism of G and if the equation has a solution, then extremal solutions of the equation are in one-one correspondence with points on the coset space $K \setminus G$ for some compact subgroup K of G such that common law of the noise μ is supported on $Kz = z\phi(K)$ for any z in the support of μ.

A necessary and sufficient condition for the existence of solutions to the equation has also been provided. This is in continuation of the work on shifted convolution powers.

C. R. E. Raja

Strong solutions of Ito's SDE's in S' (pre-print)

An extension of Ito's method of constructing strong solutions of SDE's to cases where coefficients are not smooth.

A new proof of the Monotonicity Inequality that was originally proved jointly with V. Mandrekar and L.Gawarezcki is established. Work is going on some extensions of this inequality.

B. Rajeev and Suprio Bhar

A very general multidimensional insurance model with risk reducing treaty has been formulated in terms of the Skorokhod problem of probability theory. In addition to interaction between insurance companies, the model can also incorporate investments in risky as well as riskless assets; claim arrival times and claim sizes of different companies neither need to be independent nor have finite moments. In the Markovian case, the infinitesimal generator has been identified as an integro partial differential operator; an interesting aspect is the appearance of linear complementarity problem (of operations research) in the generator.

S. Ramasubramanian

Work continued in Geometry of Banach spaces and its applications to Approximation theory. It was proved that the space of Bochner integrable functions has the one and half ball property, for a separable Banach space that has this property. Hilbert spaces have been characterized as those in which every finite dimensional subspace is a central subspace.

T.S.S.R.Kao

Some progress was made in: (i) study of maximal subgroups of group F_4 (k); (ii) determination of the multiplicities of simple $\mathbf{F}_q Sp\,(4,q)$-modules on the permutation $\mathbf{F}_q$-module on the points of the projective 3-space over $\mathbf{F}_q$; and (iii) geometry of the Ree-group of type ${}^2F_4$.

N.S.N. Sastry

In the paper 'Abelian surfaces, Kummer Surfaces and the non-Archimedean Hodege-D-conjecture', it was proved that the non-Archimedean regulator map is surjective for abelian surfaces over non-Archimedean local fields. The conjecture would be a consequence of the full strength of the Beilinson conjectures so in a sense it provides evidence for it. A new element of a higher Chow group of an Abelian surface has to be constructed. To do this, a deformation theoretic argument of Bogomolov-Hassett-Tschinkel has to be utilized and it is expected that similar methods can be used in other cases.

Ramesh Sreekantan

Applied Statistics Division

The Applied Statistics Division came into being in September 1996 in place of Applied Statistics, Surveys and Computing Division. The Computer Science Unit was renamed as the Applied Statistics Unit and the Biometry Unit was transferred to the Biological Sciences Division. Till 2005-2006, the Applied Statistics Division consisted solely of the Applied Statistics Unit. During the year 2006-2007, a new unit viz. Bayesian and Interdisciplinary Research Unit was created within this Division, which now comprises two units.

Applied Statistics Unit

Scientists of the Applied Statistics Unit (ASU) are involved in various teaching, training, research and development activities. This unit regularly conducts teaching/training programmes like winter/summer

schools, workshops and Probationers' Training for Indian Statistical Service Trainees. The members of the faculty conduct research in various areas of statistics, mathematics and computer science, with special emphasis on applications. Some members collaborate with other units of ISI on joint projects and also with scientists from other Universities/Institutes. Currently, there are collaborative on-going projects with the Theoretical Statistics and Mathematics Division, Computer and Communication Sciences Division and the Biological Sciences Division.

Sample Surveys

From an ICMR-sponsored survey, data on prevalence of certain diseases in the Kolkata Municipal Corporation area was procured. A sophisticated model-based method, starting with Hartley and Ross' unbiased ratio estimator, has been developed. In addition, the Horvitz-Thomson estimator was worked out from survey data based on Rao-Hartley-Cochran sampling and its efficiency was examined.

Arijit Chaudhuri, Mausumi Bose and Kajal Dihidar

Randomized Response in Sensitive Surveys

In the context of using distinct units from Simple Random Sampling with Replacement (SRSWR) as well as inverse SRSWR improved estimation was studied vis-à-vis the classical approach allowing repeated observations. Allowing a Direct or a Randomized Response (RR) without revealing the option explored was found to improve estimation procedure vis-à-vis compulsory RR.

Arijit Chaudhuri, Mausumi Bose and Kajal Dihidar

Design of Experiments, Combinatorial Methods and their Applications

A new construction method has been proposed for key pre-distribution schemes for distributed sensor networks. This method is based on combinations of duals of block designs. By varying the initial design, various schemes can be generated. Explicit algebraic expressions for the metrics have been obtained for local connectivity and resiliency, and the proposed schemes have been shown to be quite efficient.

Crossover designs were studied under a model where the residual effect from a treatment depends upon the treatment applied in the succeeding period. A certain class of strongly balanced designs was investigated and a lower bound for the A-efficiency of the designs for estimating direct effects was derived. These designs have been shown to be highly efficient for any number of periods.

The problem of optimal allocation of units, with given prognostic variates or covariates, among different treatments group is being studied.

Mausumi Bose and Anup Dewanji

Reliability and Survival Analysis

A nonparametric approach for estimating the distribution of quality-adjusted lifetime under some illness-death models has been developed. The problem of estimating regression parameters and baseline cause-specific hazards in competing risks framework with general missing pattern has been investigated. The problem of finding an optimal choice of design parameters in some commonly used censoring schemes in the context of Survival Analysis are being considered.

A discrete-time software reliability growth model for the analysis of software testing data with periodic debugging schedule is being considered. A nonparametric method has been developed to estimate the number of superimposed renewal processes with application to software reliability. General modeling of software reliability using information on structure is being investigated.

Anup Dewanji, Debasis Sengupta and Arnab Chakraborty

Signal Processing

To select sample time points for the estimation of the power spectral density of a continuous-time stationary stochastic process, irregular sampling schemes like Poisson sampling are preferred over regular (uniform) sampling, since estimators based on the latter are inconsistent. Assuming the sampling rate to go to infinity along with the sample size, it was shown that the smoothed periodogram based on regularly-spaced data is a consistent estimator of the spectral density, even when the latter is not band-limited. Under similar assumptions, estimators based on uniformly sampled and Poisson-sampled data have about the same rate of convergence. Monte-Carlo simulations for small samples and theoretical calculations for large samples indicated that the smoothed periodogram based on regular sampling generally has less variance and more bias than one based on Poisson sampling.

Detection of change-points at low SNR in time-critical environment using two optimal rules were studied and illustrated by several real-life examples.

Debasis Sengupta and Ashis SenGupta

Multivariate analysis

Tests for multivariate Scatter or Overall Variability were constructed in a nonparametric framework. The scope for incorporating information from auxiliary data in nonparametric estimation of multivariate density was investigated, and a suitable method was developed for this purpose. Several applications of this technique were pointed out and a data analytic illustration was given.

Ashis SenGupta and Debasis Sengupta

Several theoretical properties of multivariate zero-inflated probability models are being studied, and some real-life data has been analyzed.

Atanu Biswas

Statistical Inference

Intersection-Union tests and their relations to P^3 tests in mixture models have been studied. Bayesian methods for growth curve analysis and change-point problems were extended.

Ashis SenGupta

Categorical Data Analysis

A general model was obtained for the longitudinal categorical data set-up. Some related inference was carried out. Some work on the measures of association for nominal categorical data was also carried out. Time series analysis of categorical data (both nominal and ordinal) was also performed. Some non-stationary processes have been developed. Time series of categorical data is studied with mutual information used in place of correlation.

Atanu Biswas

Directional Data Analysis

Construction of and inference for axial distributions, asymmetric circular distributions and multivariate directional distributions have been investigated. Models and inference for directional inverse regression analysis have been extended. Generalized wrapped stable distributions, symmetric and asymmetric, have been derived and related inference procedures have been developed. Some nonstandard test procedures have been developed and theoretically studied for mean directions in the context of some eye data.

Atanu Biswas and Ashis SenGupta

Research Activities

Cryptology

Research on several areas on cryptology has been carried out by faculty members and research scholars of ASU. Included among these are theoretical aspects of hash functions, study of weak keys for RSA, correlation and biases in RC4, Boolean functions, key pre-distribution in sensor networks, broadcast encryption and modes of operations of a block cipher. The faculty members also actively participated in program committees and organization of several international conferences. In October, 2010, the institute issued a media release titled *Cutting Edge Encryption Technology Developed at the Indian Statistical Institute* and this was carried by all leading national newspapers.

Bimal K. Roy, Palash Sarkar and Subhamoy Maitra

Environmental and Health Statistics

Detection of hot spots in terms of arsenic concentration has been improved, using methods from circular data analysis and tests of isotropy.

Statistical methods have been employed to study severity of arsenic contamination in water in different parts of West Bengal. Also effectiveness of arsenic removal plants has been studied.

Ashis SenGupta

Using GIS models, the geospatial distribution of anaemia in the Darjeeling District of West Bengal has been observed and cross validation is going on. A report titled ' Geospatial Distribution of Anemia in Hilly Darjeeling District of West Bengal in India' is being prepared for possible publication.

G.N.Sarkar, S.P.Chowdhury, T. Mukherjee and Kasturi Basu

Objective Bayesian Analysis

For a class of divergence measures between posterior and prior, including the Hellinger and L-1 divergence, it was shown that maximization with respect to the prior leads to the Jeffreys prior. For multi-parameter cases with nuisance parameters, a step-by-step algorithm was used to obtain reference priors using these divergences. It was also shown that the reference priors obtained earlier for certain non-regular models maximize this class of divergence measures.

Tapas Samanta

Clinical Trials

Some work related to response-adaptive designs (used in clinical trials to allocate a larger number of patients to the better treatment, resulting in ethical gain) was carried out. In particular, optimal response-adaptive designs, designs in the context of longitudinal responses, designs for survival responses, and designs for cross-over trials were theoretically and numerically studied. Various types of objective functions and constraints were explored, resulting in a variety of techniques and solutions.

Inference on treatment difference in clinical trials was studied in the presence of surrogate responses when not all true responses are available. Existing results in the case of binary treatment responses was improved upon. Distribution of log odds-ratio was studied for such surrogate-augmented data. It was observed that efficient use of surrogate data improves the inference.

Atanu Biswas

A distribution-free approach for estimating Maximum Tolerated Dose (MTD) in the context of phase I clinical trials has been investigated. Analysis of spontaneous adverse drug reaction (ADR) reports using supplementary information in the context of drug surveillance is being considered. Optimal designs in phase II clinical trial set up is also under study where both toxicity and efficacy are under consideration. This problem is under investigation for different types of responses, and also with/without covariates.

Theory of 2D Cellular Automata, Fractals and Mathematical Morphology and its application in Computational Genomics

The possibility of classifying human olfactory receptors (ORs), and some cancer genes namely breast, oral and cervical, has been explored using three new features namely *poly-string mean*, *poly-string standard deviation* and *Hurst exponent.* Further, it has been shown that exons for OR gene subfamilies can be designed by using L-Systems—a remarkable mathematical principle that could be utilized in aroma and electronic nose industry. The mathematics of Integral Value Transformations (IVTs) and associated Dynamical Systems, namely, Collatz-like IVTs, has been studied. DNA sequence evolution of ORs has been studied through IVTs and analyzed using fractal parameters.

The nature of association among the evolutionary networks of Man, Chimpanzee and Mouse has been investigated with regards to their quantitative genomic information. The microRNAs of three species, namely, *Homo sapiens, Macaca mulatta* and *Pan troglodytes* have been studied through fractal parameters and, based on this, it has been possible to infer whether a given string of nucleotides is a probable microRNA or not.

Pabitra Pal Choudhury, Amita Pal and Arunava Goswami

Bayesian and Interdisciplinary Research Unit

Scientists of the Bayesian and Interdisciplinary Research Unit (BIRU) are involved in different kinds of research, training and development activities. The members of the faculty conduct research in different areas of statistics, applied and theoretical statistics. Some members collaborate with other units of ISI on joint projects and also with scientists from other Universities/Institutes. Currently, there are collaborative on-going projects with the Theoretical Statistics and Mathematics Division, Computer and Communication Sciences Division and the Biological Sciences Division.

Study of combinatorial aspects of statistical designs

The study of minimum critical set to retrieve the combinatorial structure uniquely has been carried out further in the context of Latin squares representing the elementary Abelian 2-group of order 8. Algorithms have been developed to construct critical sets in F-square F(2n; 2,2…..2) and the related work has been accepted for publication in *Ars Combinatoria*. Construction of critical sets for a pair of orthogonal F-squares has been studied and it has been observed that orthogonality, in the usual sense, does not reduce the size of the critical sets for a pair of orthogonal F-squares, unlike the case of a pair of orthogonal Latin squares. This has motivated the study of a pair of equiorthogonal F-squares. The combinatorial conditions for the existence of such squares have been identified and critical sets for such pairs of F-squares of size 4 and 8 with two distinct symbols have been constructed.

Rita SahaRay

Study of optimal designs

In the context of two-period crossover designs under self and mixed carryover effects, universal optimal designs for estimating mixed carryover effects have been identified. In practice, due to cost constraint, such designs are difficult to implement as they require a large number of experimental units. With this in mind, A-optimal designs for the aforementioned estimation problem have been characterized with the minimum number of observations (saturated designs) and also allowing one degree of freedom for error.

Rita SahaRay

Research Activities

Parameter Estimation in Linear and Quadratic Mixture Models involving Synergistic Effects

Research was continued in the context of mixture models involving synergistic effects, as suggested in Becker's models. Optimal designs were studied for 3-component mixtures wherein one or more pairs of components indicated synergy.

Bikas K. Sinha, Nripes K. Mandal, Manisha Pal and Premadhis Das

Sufficiency Comparisons of Statistical Experiments

In continuation to the work of Blackwell-Girshick, DeGroot, Sinha and Stepniak, a systematic study of comparison of experiments using sufficiency considerations, was carried out. Characterization of sufficient experiments in the context of (i) regression designs, (ii) one-way ANOVA random effects models, and (iii) bivariate and trivariate normal populations, was undertaken and unified results have been derived.

Bikas K. Sinha, Montip Tiensuwan and Ananta Dhungana

Statistical Assessment of Agreement

Preparation of a book on this topic, containing seven chapters, which deal with theory, methodology and applications in health and forestry sciences, was initiated and partially completed.

Bikas K. Sinha, Tapio Nummi and Montip Tiensuwan

Circular Bayesian non-parametric state-space models

The approach of the researchers, presented in their earlier work on *Bayesian Non-parametric State-Space Models*, was extended to the far more complicated and challenging situation where the state-space equations correspond to unknown functions whose inputs and outputs lie on circles. A novel methodology was proposed for Bayesian inference in these models.

Satyaki Mazumdar and Sourabh Bhattacharya

Semiparametric Bayesian palaeoclimate reconstruction

The researchers extended their earlier work on the problem of reconstructing past climate by means of a novel semi-parametric Bayesian model to relate species abundance to climate, as applied to the pollen data of Haslett *et al.* (2006). By replacing the multinomial model of the latter with a zero-inflated multinomial model, better results have been obtained.

Sabyasachi Mukhopadhyay and Sourabh Bhattacharya

Non-stationary semiparametric spatio-temporal Bayesian modelling using kernel convolution of order-based dependent Dirichlet processes

Spatio-temporal processes are important modeling tools for many problems of environmental science, biological science, geographical science, etc. However, it is usually (and somewhat unrealistically) assumed that the underlying model is parametric and that the covariance function is stationary and separable. All the previous attempts to construct nonparametric processes with covariance functions that are neither stationary nor separable fail to satisfy some desirable properties. It has been shown that suitable kernel convolution of order-based dependent Dirichlet processes rectifies all these problems and have many attractive theoretical properties.

Moumita Das and Sourabh Bhattacharya

Prior and posterior MISE convergence rates of mixture models based on Dirichlet processes: asymptotic comparison and choice of parameters

The posterior rate of convergence of the Dirichlet process-based mixture models proposed by Escobar and West (1994) and Bhattacharya (2008), was computed In terms of MISE (Mean Integrated Squared Error), and it was shown that the latter converges much faster. Inspired by these asymptotic results, a method for the selection of the "maximum" number of components, *M*, and the parameter of the strength of the base measure, α, of the model of Bhattacharya (2008), was proposed. The prior MISE convergence rate of the latter with respect to *M* and α under suitable assumptions on the base measure, was also computed, and the resultant choices of *M* and α were compared with those associated with the posterior convergence rate.

Sabyasachi Mukhopadhyay and Sourabh Bhattacharya

Perfect simulation in clustering of categorical time series with unknown number of clusters

A methodology for clustering in categorical time series with unknown number of clusters has been proposed, and the perfect sampling theory of mixtures of unknown number of components of the researchers has been extended for exact Bayesian inference in this case.

Sabyasachi Mukhopadhyay and Sourabh Bhattacharya

Recent advances in perfect sampling

A comprehensive review of recent advances in perfect simulation theory was carried out, showing that many challenging realistic Bayesian problems can be handled via perfect simulation, completely eliminating the problems of assessment of MCMC convergence.

Sabyasachi Mukhopadhyay and Sourabh Bhattacharya

Bayesian Model Selection---Theory and Methods

The first version of a Springer Monograph on this topic was prepared and submitted for review.

Jayanta K. Ghosh, Arijit Chakrabarti, Mohan Delampady and Tapas Samanta

Model Selection, Nonparametric Function Estimation

Bayesian Model Selection for prediction purposes has been studied. In particular, cross-validatory predictive density as a model selection criterion has been studied and optimality results have been found on the fraction of sample to be kept for validation and fraction to be kept for estimation. Related Oracle properties of such rules have also been studied. Adaptive rate optimal estimation of regression function using the Akaike Information Criterion (AIC) has also been studied.

Arijit Chakrabarti

Application of Mahalanobis-Taguchi strategy in pattern recognition

Application of Mahalanobis-Taguchi systems to pattern recognition was studied which led to a non-parametric classifier based on Mahalanobis distance. The method is intuitively appealing, simple yet competitive with sophisticated classifiers. Currently a generalization of Fisher's discriminant analysis is being studied for heavy-tailed distributions. Initial results are quite promising.

Rita SahaRay, Smarajit Bose and Sujit Majumdar

Application of statistical methodologies in content-based image retrieval

Combinations of different approaches of relevant feedback produced significantly better results. A segmentation-based approach was developed which yielded similar performance. However, combined with the conventional approach, this segmentation-based approach considerably improved the results.

Smarajit Bose, Amita Pal, Dipti Prasad Mukherjee and Bhabatosh Chanda

Research Activities

Multivariate majorization

Different types of multivariate majorization have been reviewed and their relations and implications have been studied. These have been used to study the relations and implications of several multivariate inequality measures.

Subir Kumar Bhandari

Stochastic models for study of Fertility

In connection with couple fertility, stochastic models have been developed incorporating socio-cultural factors to explain and analyze observed data on various types of birth intervals and number of births to couples in a specified period of time and to outline new procedure for obtaining the estimates of the parameters involved in these models.

Sankar Dihidar

Consistent estimation of scale matrix of elliptical distributions

A method of estimating consistently the scale matrix of an elliptical distribution which can be written as a scale mixture of multivariate normal distributions has been obtained. The estimation strategy is two-stage: it estimates the "correlations" in the first stage and the diagonal entries of the scale matrix in the second stage. The estimators obtained in the first stage do not require the assumption about the specific elliptical distribution under consideration. In other words, these estimates are valid under any elliptical distribution with the same location vector and scale matrix. However, the specific form of the elliptical distribution is needed in the second stage. This method can be employed, for instance, to estimate the scale matrix of multivariate *t*-distribution with known degrees of freedom. Also, as an application, the estimates are used as initial choices for estimating the parameters of a multivariate *t*-distribution with known degrees of freedom by EM algorithm. The estimates appear to be useful for implementing the EM algorithm for multivariate *t*-distribution with small degrees of freedom. As a matter of fact, the need to develop the estimates was felt in such circumstances.

Sumitra Purkayastha

Parametric testing of hypothesis using the Density Power Divergence

The Density Power Divergence is a prominent member of the class of density based divergences, which has shown great potential in generating robust parameter estimates. However the usefulness of these divergences in constructing robust tests of parametric hypothesis is yet to be studied. A study has been undertaken which proposes a class of robust tests of hypothesis based on the density power divergence. The study is considering the asymptotic properties of the test statistic, and its performance in small samples. Initial indications suggest that these tests can serve as useful alternatives to standard tests based on the maximum likelihood estimator in many cases.

Ayanendranath Basu

Analysis of olfactory receptor genomic clusters at the functional level using Boolean function/cellular automata and pattern recognition techniques

The efficacy of several sets of features in discriminating functional olfactory receptors from non-functional ones has been explored and the best discrimination was achieved with proportions of 20 amino acids and the three stop codons in each gene, as features. Among several classifiers explored, an MLP with 4 hidden nodes performed best on an average.

Simultaneously, the possibility of applying syntactic pattern recognition methods based on stochastic grammars has been explored for tackling noise/ambiguity. So-called s*equence motifs* have been identified, and it has been possible to assign probabilities to each motif with respect to every OR protein sequence in the training set. This has enabled the formulation of the stochastic grammar-based approach for discrimination.

Amita Pal, Pabitra Pal Choudhury and Arunava Goswami

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit

The research activities of the Advanced Computing and Microelectronics Unit (ACMU) comprise theoretical and applied research in the areas of high performance computing, pervasive and mobile computing, wireless and sensor networks, VLSI design tools and electronic design automation, logic synthesis and testing, error correction and fault-tolerance, physical design of microchips, embedded systems, system-on-a-chip, low-power architectures, computational geometry, algorithms and data structures, computational biology, hardware for image processing, nano-technology and giga-scale integration techniques, hardware and software validation. During the period 2010-2011, the faculty members of the unit were engaged in the following research projects:

a) Power and bandwidth management in wireless networks
b) Computer-aided design and testing of digital microflidic nano-bichips
c) Developing two labs (i) Nano-CAD (ii) Cluster Computing
d) Low-memory algorithm
e) Energy-efficient routing in mobile ad-hoc networks
f) Automated debugging for evolving programs
g) Multi-valued logic for quantum computers
h) Techniques for robust physical design of nanometer ICs
i) Moving guards in polygonal environment
j) Geometric covering problems

Power and Bandwidth Management in Wireless Networks

In low power wireless networks, e.g., mobile and sensor networks, one of the major concerns is the energy efficient communication so that battery power can be saved as much as possible. Also, with a limited amount of available bandwidth, allocation of channels to ever-increasing number of cellular mobile users for multimedia communication is a challenging research problem. Another related recent problem is the judicious allocation of channels to the uncoordinated wireless 802.11 hotspots, in order to optimize the performance of the network and fairness to all clients connected to the access points in respect of channel sharing. Accordingly, the following problems in this project have been taken up: (i) development of cost-effective techniques for energy-efficient communication in low power wireless networks (particularly dealing with the physical layer and the MAC layer), and (ii) development of efficient algorithms for channel assignment in multimedia cellular mobile networks as wells as in uncoordinated wireless 802.11 hotspots. We would like to explore different possible source coding and channel coding schemes along with different modulation schemes in order to achieve some savings in transmitter and receiver energy requirements even in presence of noise in channels.

Another important concern in wireless communication is that of bandwidth management. In cellular mobile networks, there is almost an exponential growth in the number of users over the past decade, and hence, the demand for the communication channels is ever increasing with time. On the other hand, the available bandwidth is limited to a small value. The situation has been further worsened due to the recent increasing trend of multimedia communication by the mobile users in the form of voice, text, still image and video. In the area of energy-efficient communication, we have found a novel source encoding technique based on redundant binary number system coupled with the idea of silent communication of 0‘s in the message string, which provides a saving of about 53% transmitter energy for AWGN channels.

In the area of cognitive radio networks, we have addressed the problem of channel sensing, channel allocation and transmission of multimedia signals, while maintaining the required Quality of Service

(QoS) constraints. Depending on the type of signal and QoS requirements, different types of multimedia signals need different bandwidths for communication. In typical wireless systems, unless a contiguous frequency band in the spectrum with width at least equal to the required bandwidth is obtained, multimedia communication can not occur with the desired QoS. We have proposed here a novel technique based on Sample Division Multiplexing (SDM) to overcome this issue. Our approach is based on utilizing several frequency bands, each of smaller width than the required bandwidth but whose sum total equals at least the required bandwidth. Algorithms for channel reservation, channel sensing and allocation along with protocols for transmission and reception have been developed. Our approach also ensures preemption of secondary users by the primary users as typically demanded in a cognitive radio based communication environment.

Bhabani P. Sinha

Computer-Aided Design and Testing of Digital Microfluidic Nano-Biochips

A lab-on-a-chip combines microfluidics, (bio) chemistry, embedding of electronic and optical sensors, and microchip fabrication technology. Recently, major advances have been made for miniaturization of a biomedical laboratory deploying highly integrated and automated lab-on-a-chip systems. Performance of a nano-bio chip depends on the ability to manipulate very small amount (micro/nano/pico litre volume) of fluids, rapidly and automatically, on-chip. Though continuous-flow microfluidic chips are being developed, a more versatile category of biochips relies on the principle of either *dielectrophoresis* (DEP) or *electrowetting-on-dielectric* (EWOD) actuation. Such devices are called *digital microfluidic biochips*. Discrete droplets of micro/nano/pico litre volume of samples and reagents can be manipulated using a two-dimensional array of electrodes. As each droplet (or group of droplets) can be controlled individually, these types of biochips also have dynamic reconfigurability and architectural scalability. To build a biochip efficiently, several associated design problems need to be solved, which require expertise in multidisciplinary areas including semiconductor process technology, interface design, combinatorial optimization, CAD tools, and biology. In this project, we have studied several combinatorial and geometric optimization problems that arise during the computer-aided design (CAD) and testing phases of biochip development. The proposed solutions can be used for sample/reagent preparation, for bioassay executions on the biochips, and for testing the fabricated chips.

Bhargab B. Bhattacharya

Developing two labs of the Unit: (i) Nano-CAD Lab and (ii) Cluster Computing Lab

As envisaged in the current Vision Document and Perspective Plan of the Institute, the Unit has established two new labs of the unit (namely, Nanotechnology CAD Lab, and Cluster Computing Lab) to be used by faculty members, research fellows, and the M.Tech.(CS) students of the Institute.

Bhargab B. Bhattacharya, Susmita Sur-Kolay and Nabanita Das

Low Memory Algorithms

This project focuses on designing low memory algorithms for different geometric optimization problems that often arise in the context of wireless sensor network and image processing applications. Low memory algorithms signify constant working space or low working space for the execution of the algorithm over and above the linear space needed for storing the input. This is a new paradigm in algorithm design that has caught attention with application areas that deal with huge data.

We have proposed an in-place algorithm for constructing the priority search tree for a set of n points in 2D that runs in $O(n \log n)$ time using $O(\log n)$ extra bits apart from the input array. In this implementation, all the standard queries of priority search tree can be performed in $O(\log^2 n)$ time. We used this data structure, to compute the maximum area empty axis-parallel rectangle with the same point set that runs in $O(R + n \log n)$ time, where R is the number of maximal empty rectangles present on the floor.

Arijit Bishnu

Energy-Efficient Routing in Mobile Ad-hoc Networks

Mobile ad hoc networks have become an area of active research in recent years due to its power of networking without the support of any existing infrastructure. This project aims to propose efficient distributed algorithms for self-organization in such networks.

Given a random distribution of *N* wireless sensor nodes, a novel distributed algorithm has been proposed for generating *n* partitions such that sensors in each partition remain connected and at the same time covers the area to be monitored. Activating the partitions in round robin fashion essentially enhances the lifetime of the network *n* times. Simulation studies have been done using NS2 that showed the performance of the proposed distributed algorithm is comparable with that of centralized versions proposed earlier though it requires less computation time and less message overhead.

Also, for conflict-free communication in WSN following TDMA, a distributed energy-efficient slot assignment algorithm is developed that improves the message communication overhead keeping the frame length comparable with that achieved in earlier works.

Nabanita Das

Automated Debugging for Evolving Programs

Debugging denotes the process of detecting root causes of unexpected observable behaviour in programs (such as a program crash, an unexpected output value being produced or an assertion violation). Debugging program errors is a difficult process, and often takes a significant fraction of the time in the program development stage. Even today, debugging remains much of a manual activity, with the actual debugging time dependent on the size and complexity of the program being debugged, the nature of manifestation of the bug and the level of familiarity and expertise of the programmer. The standard practice of debugging till date in the software community is to manually inspect the execution trace exhibiting the bug inside a debugger and try and locate the error cause(s) from an observed error.

It is a widely accepted reality in any large-scale development that a complex piece of program is never written from scratch. Usually a program evolves from one version to another. This is termed as program *evolution* where one program version *evolves* to a new version. When we change a program version to produce a new version, we may introduce *bugs*. The main objective of this work is to devise efficient means for debugging change-induced bugs, which are absent in an earlier version of a program but present in a modified buggy version of the same. The following problems have been / are being studied in this context: (i) formal methods and debugging principles for debugging evolving programs (ii) modeling of standard re-factorings for programs and their effects on automated debugging, (iii) model checking of evolving programs

Ansuman Banerjee

Universal Mobile Telecommunications System Networks: Planning and Design

The Universal Mobile Telecommunications System (UMTS) network is a 3G cellular mobile network based on flexible but complex Wideband Code Division Multiple Access (W-CDMA) scheme. The problem of planning UMTS networks involves selecting site locations and configuring transmission infrastructure so that coverage and capacity objectives are met. As compared to the Global System for Mobile Communications (GSM) network, the UMTS networks are much more challenging to plan because the planning problem cannot be subdivided into the independent problems of providing adequate signal strength for area coverage and assigning channels.

We have introduced the concept of flexible grids to reduce the computation time of the planning problem by allowing the number of test points to be dynamically varied during the planning phase. We have also derived the upper and lower bounds for transmitter and total pilot power requirements for UMTS systems. Lower bounds are derived via an integer linear programming approach and upper

bounds are derived using a meta-heuristic approach (tabu search). The effectiveness of the meta-heuristic approach is then evaluated against the derived lower bounds. We have also formulated and derived the bounds on maximum achievable service coverage ratio subject to the available resources. A load approximation algorithm has been developed which substantially reduces the computational complexity while ensuring that no cell is overloaded. We have shown that our approximation algorithm can achieve good coverage accuracy in comparison to the obtained bounds using much lesser computational time at the cost of slightly higher power requirement.

Sasthi C. Ghosh

Multi-valued Logic for Quantum Computers

Quantum computing and quantum information science are emerging research areas. Design of efficient quantum computing hardware architectures is mandatory for building real quantum computing machines. Most of the works focus on binary logic whereas multi-valued logic has the advantages of less hardware cost. Defining ternary logic in quantum domain has been achieved and utilized for synthesis of ternary logic quantum circuits.

Susmita Sur-Kolay

Techniques for Robust Physical Design of Nanometer ICs

In robust and reliable design of integrated circuits using nanometer fabrication technology, intellectual property protection of the design has been addressed. A nanometer IC fabricated from a good physical design may not provide desired performance due to manufacturing defects. Necessary additions and corrections to the layout of multi-layer design are performed which add significant IP value to the manufacture-friendly layout. Hence, IP Protection for Design-For-Manufacturability (DFM) is essential. The signature of the owner of DFM tool can be embedded through DFM techniques such as OPC, RET, metal filling. In this project, we have developed the following:

- a fast scheme using few additional buffers for watermark embedding and extraction;
- a method for signature insertion and extraction by modification of few buffers in the repeater system with negligible area and delay overhead;
- a tree-encoding algorithm has that provides high degree of robust IPP for direct IP protection of custom design layout style floorplans;
- a leakage-proof zero-knowledge protocol for public verification;
- an algorithm for protection of hardware IP, and induction of area-fill geometries as part of the signature to obtain *a unified solution for mechanical and IPP robustness of a design* has been devised to minimize the overall area and performance overhead.

Susmita Sur-Kolay

Moving Guards in Polygonal Environment

Research on geometric algorithms for moving objects has become very important in the context of robotics and mobile network management. Our proposed problems will aid in scheduling the path of the guards in polygonal environment satisfying some realistic constraints that arises in many applications.

We have proposed an algorithm to locate a position of a guard on the convex hull of a simple polygon *P*, such that the distance of the farthest point on the boundary of *P* from the location of the guard avoiding the interior region of the polygon *P*, is minimum. We have proposed an *O(n)* time algorithm for locating such guard on a simple polygon of *n* vertices. Two points *a* and *b* are said to be L-visible among a set of polygonal obstacles if the length of the shortest path from *a* to *b* avoiding these obstacles is no more than *L*. For a given convex polygon *P* with *n* vertices, Gewali et al. addressed the guard placement problem on the boundary of *P* that covers the maximum area outside to the polygon under L-visibility with *P* as obstacle. Their proposed algorithm runs in *O(n)* time if $L<\pi(P)/2$, where $\pi(P)$

denotes the perimeter of P. They conjectured that if $L \geq \pi(P)/2$, then the problem can be solved in subquadratic time. We have settled the conjecture in the affirmative sense, by proposing an easy to implement linear time algorithm for any arbitrary value of L. A path from s to t on a polyhedral terrain is descending if the height of a point p never increases while we move p along the path from s to t. No efficient algorithm is known to find a shortest descending path (SDP) from s to t in a polyhedral terrain. We have proposed two approximation algorithms that solve the SDP problem on general terrains. We also introduce a generalization of the shortest descending path problem, called the shortest gently descending path (SGDP) problem, where a path descends, but not too steeply. The additional constraint to disallow a very steep descent makes the paths more realistic in practice. We have proposed two approximation algorithms to solve the SGDP problem on general terrains. All of our algorithms are simple, robust and easy to implement.

Sandip Das

Geometric Covering Problems

Covering problem is a computationally hard problem, and studies are going on for designing efficient heuristic/approximation algorithms for these problems. The problem is very important in several application areas including wireless sensor network, robot path planning and other similar facility location problems. We have considered the some important combinatorial optimization problems on unit disk graphs. Our achievements in this project are stated below:

Given a set S of n pre-placed radio-stations and a source station s , we consider two variations of minimum cost homogeneous range assignment problem for the 2-hops broadcast from s to all the members in S, where the range assigned to a radio-station is either zero or a fixed value r. Thus, the cost of range assignment is proportional to the number of radio-stations having range r. The variations we study are (i) find the value of r and identify the radio-stations with range r such that the total cost is minimum, and (ii) given a real number r, check whether homogeneous 2-hops broadcast from s to the members in S is possible with range r, and if so, then identify the smallest subset of S whom range r is to be assigned such that 2-hops broadcast from s is possible. The first problem is solved in $O(n^3)$ time and space. But, the second one seems to be hard. We present a 3-factor approximation algorithm for this problem, which runs in $O(n^2)$ time. An $O(n^2)$ time heuristic algorithm for the second problem is also presented. Most of the times, it produces optimum result for randomly placed radio-stations.

We have studied a variation of Quality of Surveillance (QoSv) problem in sensor network, where the objective is to find the longest straight line segment that does not pass through the sensing zone of any sensor. It can be seen as the longest length that an intruder may travel along a straight line, before being detected. An easy to implement algorithm for computing the QoSv in a rectangular field R containing a set of n identical sensors is proposed. The time and space complexities of our algorithm are $O(n^2 \log n)$ and $O(n)$ respectively. It is also shown that a minor modification of the algorithm runs in $O(n^2)$ time and space.

Subhas C. Nandy

Computer Vision and Pattern Recognition Unit

OCR and Document Processing

A high accuracy multi-font OCR for printed Bangla books have been developed using SVM classifiers that for 1000 pages has given an averag of 97.58% accuracy. We are working to make it more robust to work for 25 fonts. In that connection, we have proposed a new measure of OCR accuracy, which is more accurate than Edit distance based method. Another work done recently is to develop multi-script document identification at arbitrary orientation for all Indian scripts. Previous work used to detect script assuming that the document pages are all in correct orientation. We have also proposed a new scheme of Hough transform based on Digital Straight line instead of analog representation of the straight line. Also, skew correction of the document images by digital counter-rotation of the co-

ordinate system has been proposed. For handwritten text, some data have been collected and segmentation into smallest number of maximally meaningful components is tested.

B. B. Chaudhuri, S. Ghosh, S. Banik and M. Bose

Automatic Reading of Texts in Camera Captured Images

We developed a novel scheme based on Laplacian operation for localization of texts in camera-based scene images. The present scheme is observed to be significantly robust in the presence of illumination variation and various other noises. We simulated this scheme on our recently developed database of approximately 300 outdoor scene images captured from Indian roads. These images contain texts of one or more of the scripts Devanagari, Bangla and English. The performance of our scheme on the sample images is satisfactory irrespective of the script. We also collected simulation results on the samples of ICDAR Robust Reading Competition, 2003 image database and these are equally satisfactory. We also studied a novel approach for correction of perspective distortions in outdoor scene images based on a common characteristic feature of texts of Devanagari, Bangla and English.

U. Bhattacharya, S. K. Parui, P. Samanta and S. Mondal

Unconstrained Online Handwriting Recognition – Bangla

Unconstrained handwriting in Bangla is often a mixture of isolated and/or cursively written groups of characters. Recognition of such unconstrained handwriting is the most difficult. We recently developed a limited vocabulary word recognition engine based on a novel hidden Markov model for unconstrained handwriting in Bangla. Simulation results on our recently developed database of Bangla handwritten words show that the present approach outperforms traditional hidden Markov model based approach.

S. K. Parui, U. Bhattacharya and O. Samanta

Online Handwritten Isolated Character Recognition

We developed benchmark recognition results of recently developed online handwritten isolated character databases of four most popular scripts of the Indian subcontinent based on two existing feature extraction methods viz. point-float and direction code histogram features and three classifiers viz. Nearest Neighbour (NN), Multilayer Perceptron (MLP) and Hidden Markov Model (HMM) to facilitate effective future research on online handwriting in these Indic scripts.

U. Bhattacharya, S. K. Parui, T. Mondal and K. Das

Natural Language Processing

A spellchecker has been designed for Bangla text word-processing, where a multi-trie structure has been proposed. It is a generalization of our earlier work on reversed-word dictionary to take care of up to 3 errors in a word. The approach is much faster than the Levensthein automaton traversing on the lexicon trie. Another work done is an exhaustive characterinzation of sound symbolism in Bangla including compilation of a dictionary of onomotopoetic words as well as words derived from them in this language. The work has been published as a book from West Bengal Bangla Academy.

B. B. Chaudhuri, S. Ghosh, S. Banik and M. Bose

Multi-Script Document Recognition

A robust language independent handwritten text line segmentation technique has been proposed where painting concept has been applied. Also to segment touching characters of arbitrary orientation a scheme has been proposed. In the present scenario retrieving information from document images is a challenging problem. We have developed a retrieval system based on the seal information present in the documents. We also developed a feature based word-spotting technique for some of the Indian

languages. Because of low resolution, text extraction from video document images is a difficult problem. We have proposed a novel method that uses proximity based symmetry for classifying text frames from video frames. Also we developed a few methods for text exactions from video images. Because of multi-lingual behavior, destination address block of a postal document of an Indian state may be written in two or more scripts. From a statistical analysis of Indian postal document we noted that about 22.04% of Indian postal documents are written in two scripts. Because of inter-mixing of these scripts in postal address writings, it is very difficult to identify the script by which a city name is written. To avoid such identification difficulties, we proposed a lexicon-driven bi-lingual (English and Bangla) city name recognition scheme for Indian postal automation. Also for automatic bank check processing, a lexicon driven segmentation-recognition scheme is proposed for the legal amount recognition of Indian bank check.

Automatic identification of an individual based on his/her handwriting characteristics is an important forensic tool. In a computational forensic scenario, presence of huge amount of text/information in a questioned document cannot be always ensured. Also, compromising in terms of systems reliability under such situation is not desirable. We proposed a system to encounter such adverse situation in the context of Bengali script. Arbitrary orientation and sparse data content are common characteristics of torn document. To ensure accuracy and reliability in computer-based analysis, content-zone segmentation is required. A questioned document-piece in the form of an office note, however, might also contain non-text data like logos, graphics, and pictures. Hence a more precise content-zone classification is required and for this purpose we propose a two-tier approach for non-text, handwriting and printed text segmentation. The first tier aims to discriminate text and non-text regions. The second tier classifies handwritten and printed text within all text zones identified during the first tier. Gabor features and chain-code features are used here. Finally, some of the databases (e.g. handwritten text for line segmentation, Indian street names written in Bangla) etc. have been developed.

U. Pal and R. Mandal

Information Retrieval

A comprehensive comparative study of query expansion techniques has been initiated. Work on Information Retrieval from legal documents has also been started. Preliminary results are very encouraging. A new graph-based language-independent stemming algorithm was developed. The algorithm has been tested on a variety of languages and yielded excellent results.

A. Bandyopadhyay, K. Ghosh, P. Goswami, M. Mitra, J.H. Paik, D. Pal, S. Palchowdhury and S.K. Parui

Machine Authentication of Security Documents

A general machine-based framework for authentication of security paper documents is investigated. Automatic authentication of bank notes, cheques, certificates, etc. is considered as the end goal of this research.

Utpal Garain

Modeling of Document Degradation

The degradation of documents which have been preserved for many years is modeled in order to predict age of documents for which publication years are not known.

Utpal Garain

Evaluation of Text Chunking

A new evaluation method has been designed for measuring efficiency of text Chunkers.

Utpal Garain and Arnab Dhar

Research Activities

Evaluation of Math Recognizer

A novel tree-matching based approach has been designed and made net-available for measuring efficiency for machine recognition of printed or handwritten mathematical expressions.

Utpal Garain

Signal and Image Processing

Improvement of algorithms for the analysis and correction of hearing disabilities: The objective of this work is to expand the scope of existing hearing compensation methods, by incorporating source separation capability. The system has three consecutive modules. The first performs separation of independently occurring audio signals from signal mixtures obtained from multiple microphones. The second performs discrimination and consequent elimination of the undesired signal according to the choice of the user. The third module processes the desired signal in accordance with the user's hearing deficiencies. The algorithms are being finalized and implemented on a digital signal processor. This work would pave the way for improved hearing aids with easily adjustable controls for speech, music and other types of audio signals.

Digital Image watermarking for the assessment of quality of service: The degradation of a known watermark embedded in images/videos transmitted over a network is evaluated in order to form a quantitative measure of the overall degradation. Both robustness and fragile aspects of watermarks are exploited in order to have blind, yet efficient schemes. Other applications of digital watermarking like tamper detection and proofing are also being explored.

S. Palit, S. De and A. Bhattacharya

Documentation, Research and Training Centre (DRTC), Bangalore

Knowledge Organization

The focus of the Knowledge Organization has transformed substantially in the last one decade and as a direct consequence of the emergence of digital resources, digital libraries and the World Wide Web. Knowledge organization, today, has to meet the twin objectives of facilitating organization of information resources for effective retrieval while at the same time look at ways and means of effective tagging of the huge volume of digital resources to support retrieval at tolerable levels of precision. Research on the following issues is being carried out:

1. How to reshape and sharpen traditional knowledge organization tools such as classification schemes and thesauri to meet the changing and widening requirements of information representation and retrieval? A revised edition of Colon Classification in Kannada is in the press and a completely revised edition in English is expected to be released in 2011. The issues related to multilingual thesauri and lateral relations in the Humanities (Over 10 papers have been published on these aspects in the last 3-4 years) are also studied.
2. Studies related to application of facet analysis in developing ontologies.
3. Use of digital technologies to reduce the digital divide to the extent possible.

K. S. Raghavan, A. R. D. Prasad and Devika P Madalli

Digital Libraries and Semantic Web

1. Research carried out in faceted ontologies in social and media research. Study of Wordnet for semantic compatibility as part of EU funded FET Living Knowledge Project, under taken. The main objective of the project is to develop ontologies using faceted approach, in order to provide folksonomies which should facilitate visualizations to the end-user. Actively pursuing research in web ontologies using RDF (Resource Description Framework), OWL (Web Ontology Language) and SKOS (Simple Knowledge Organization system). The ultimate goal is to develop context based search mechanisms combined with inference engines.

2. Digital Library of DRTC conference and seminar volumes project completed and implemented.
3. Co-Hosted the International Conference on Semantic Web and Digital Libraries, 2009, Trento, Italy, ICSD-2009, Sept. 8-11, 2009. It was a sequel to ICSD, 2007 which was organized by ISI as part of platinum jubilee. The next sequel may take place in United States

A R D Prasad and Devika P Madalli

Library and Information technology

In the recent past, several technology applications to library and information work have been demonstrated. As a part of this kind of research, a LiveCD called Liblivecd had been released. It is preconfigured with Dspace digital library software + Koha, Library Management Software + PKP Harvester (which collects metadata from various digital/institutional repositories to provide a single stop search engine) + dbwiz, a federated search engine which facilitate searches across e-jounals and online databases. The Liblivecd is hosted on http://sourceforge.net/projects/liblivecd. As of May, 2010 more than 3000 downloads have taken place.

A R D Prasad.

Institutional repositories

In the 1990's a movement was started to enhance public access to scholarly journal articles through the pre-print servers. In these servers, authors would deposit their pre-prints. It thus provided readers worldwide with a quick access to research outputs. These types of servers began as informal vehicles for the dissemination of preliminary research and those literatures which were not peer reviewed. However, the last decade witnessed the rapid evolution of these into increasingly important media for dissemination of research results in certain fields. In this context attempts were made to:

- Study the Feasibility of designing and developing an appropriate prototype Institutional Repository (IRs) model using open source software and easily implementable in all the universities in India.
- Study the adequacy of existing standards in this regard especially for scholarly material in Indian languages and scripts.
- Design an end user interface for browsing, navigating through and searching the Institutional Repository.

Dr. M.Krishnamurthy

Bibliometrics and Scientometrics

Attempts were made to study the growth of literature and its impact on library collection development. Different scientometric measures such as h-index, g-index and impact factors were also studied. A project was also under taken to study the pattern of downloading of online literature.

I K Ravichandra Rao and Priyanki Sinha

Electronics and Communication Sciences Unit

Study on Temporal Variation of Aerosol in Relation to Variation of Boundary Layer at Giridih (Indo-Gangetic Plain)

In this research project, aerosol content of the atmosphere over the south eastern part of Indo-Gangetic plane, especially at the colliery belt at Giridih, Jharkhand is to be monitored, measured and estimated. Based on data, its socio economic impact over these regions the aerosol content data is to be analysed. To monitor respirable suspended particulate matter (RSPM), an RSPM monitoring machine has been procured in Feb., 2011 and installed at ISI Giridih on March 2011. Some desirable data have been collected from RSPM machine but due to improper and too much fluctuation of local supply voltage, some problem in machine has been observed, causing interruption of work. Necessary remedial steps would be taken for proper functioning. Two project linked personnel are (recently

recruited) doing library work for searching/reading journal/technical reports related to this project. Apart from this, some analysis/estimation work on Ozone data (courtesy, NPL, Delhi) is being continued.

A. K. De

Image and Video Processing and Retrieval

A sketch to photo synthesis algorithm is developed using active appearance model and LLE search. The method has many applications in forensic and criminology. As applications of image analysis techniques to forensic and criminology, algorithms for off-line signature verification and writer recognition are developed using image morphology. A statistical runs test based algorithm is developed for sub-shot detection and key-frame extraction. Such key-frames are arranged chronologically for generating storyboard, which may be treated as means to video summarization and indexing. Shots are further grouped together, following pseudo-periodicity, to generate scene as a higher order representation unit of video.

B.Chanda

Analysis of atmospheric boundary layer structure from SODAR data collected from Antarctic during 15th Antarctic Expedition has been performed. Atmospheric structure classifier using statistical and frequency domain features of Antarctic SODAR data has been developed. Online noise cleaning of return echo received by SODAR system is being developed using frequency domain analysis.

N. C. Deb

Studying Architectural Distortion in Mammogram

Architectural distortion of breast tissue is usually associated with malignant changes. Capturing architectural distortion in mammogram image amounts to capturing a set of irregular texture pattern in breast tissue. We are investigating algorithms to extract texture orientation field that describes high level pattern for differentiating malignancy and benign characteristics present in mammogram image.

D. P. Mukherjee

http://www.isical.ac.in/~ecsu/nrp/nrp_editorialactivities.pdf**Computational Intelligence**

There are many averaging operators defined for Atanassov's intuitionistic fuzzy sets (AIFSs). We have shown how such averaging operators can be represented by using additive generators of the product triangular norm, which simplifies and extends the existing constructions. We have also provided two generalizations of the existing methods for other averaging operators. We relate operations on AIFS with operations on interval-valued fuzzy sets. Finally, we also propose a new construction method based on the Lukasiewicz triangular norm, which is consistent with operations on ordinary fuzzy sets. Using a fuzzy rule based framework, we have proposed design mechanisms for simultaneous identification of decision making systems and selection of appropriate attributes. Such systems aim at selecting necessary features and discarding derogatory and indifferent features. Our approach can also control the level of redundancy in the selected feature set.

N. R. Pal

Bioinformatics

An innovative unsupervised method, called Motif Finder, (in short, F-Motif) for identification of phosphorylation motifs is developed. F-Motif uses clustering of sequence information represented by numerical features that exploit the statistical information hidden in some foreground data. Three different encoding methods, including a novel position contrast matrix and the most simple orthogonal coding, are used and the motif discovery ability of F-Motif is found to be quite robust with respect to encoding schemes.

N. R. Pal

DNA Computing Based Approximate Reasoning

In the year 1971 Zadeh proposed fuzzy logic based approximate reasoning. Since then several potential extensions and applications on approximate reasoning have been developed by different researchers. Recently an approximate reasoning using DNA computing has been proposed by us. This approximate reasoning was essentially proposed by Adleman in the year 1994. Some inherent drawbacks of existing fuzzy logic have been replaced by DNA chemistry. The ultimate goal of this work is to develop computing with perception which would be quantified by membership function of DNA oligonucleotide sequences.

K. S. Ray

Machine Intelligence Unit

Bioinformatics

Design of a suitable lead molecule is an important step in rational drug discovery. A variable length genetic algorithm based method, IVGA3D, for the design of lead molecules in three-dimensional space has been developed. It shows improved results when compared to several existing techniques in terms of the interaction energy between the ligand and the protein target. The designed molecules are also found to have some nice drug-like properties. MicroRNAs (miRNA) are short non-coding RNAs believed to be intricately involved in many diseases including cancer. It is well-known that miRNAs regulate target mRNAs through translational repression or degradation. However, the regulation of miRNAs is not yet well-understood. A database called PuTmiR has been developed that provides a list of putative transcription factors that might potentially regulate a given miRNA. This is an important resource for studying miRNA regulation. Multi-class clustering of cancer subtypes using a recently proposed method integrating SVM based supervised learning with multiobjective clustering has been undertaken in a part of the study. This results in the identification of cancer gene markers.

S. Bandyopadhyay

Genome sequencing of humans and other organisms has led to the accumulation of huge amounts of data, which include immunologically relevant data. A large volume of clinical data has been deposited in several immunological databases and as a result immunoinformatics has emerged as an important field which acts as an intersection between experimental immunology and computational approaches. It not only helps in dealing with the huge amount of data but also plays a role in defining new hypotheses related to immune responses. An extensive review of classical immunology, different databases and prediction tools has been made. Applications of immunoinformatics in designing *in silico* vaccination and immune system modeling have also been described.

R. K. De

In order to apply the powerful kernel based pattern recognition algorithms such as support vector machines to predict functional sites in proteins, amino acids need encoding prior to input. In this regard, a new string kernel function has been proposed that maps a non-numerical sequence space to a numerical feature space. The proposed string kernel function needs a basis string as a support. The concept of zone of influence of basis string has been introduced in the proposed kernel function to take into account the influence of each basis string in non-numerical sequence space. An efficient method has been described to select a set of basis strings for the proposed kernel function, integrating the Fisher ratio and the concept of degree of resemblance. The integration enables the method to select a reduced set of relevant and non-redundant basis strings. Some new quantitative indices have been introduced for evaluating the quality of selected basis strings. The effectiveness of the kernel function and string selection method has been demonstrated on different protein data sets.

One of the major tasks with gene expression data is to find groups of co-regulated genes whose collective expression is strongly associated with sample categories. In this regard, a new supervised attribute clustering algorithm has been proposed to find such groups of genes. It directly incorporates

the information of sample categories into the gene clustering process. Some new quantitative measures have been introduced based on fuzzy-rough sets that incorporate the information of sample categories to measure the similarity among genes. The proposed algorithm is based on measuring the similarity between genes using the new quantitative measures, whereby redundancy among the genes is removed. The clusters are refined incrementally based on sample categories. The effectiveness of the algorithm has been demonstrated on different cancer and arthritis data sets. The biological significance of the generated clusters has been interpreted using the gene ontology.

P. Maji

Systems Biology

A new method for identifying a set of optimal gene regulatory pathways has been developed by using structural equations as a tool for modeling gene regulatory networks containing feedback loops. The method, first of all, generates data on reaction flows in a pathway. A set of constraints has been formulated incorporating weighting coefficients. Finally the gene regulatory pathways have been obtained through optimization of an objective function with respect to these weighting coefficients. The effectiveness of the present method has been successfully tested on ten gene regulatory networks existing in the literature. A comparative study with the existing extreme pathway analysis also formed a part of this investigation. The validated pathways point to a combination of previously documented and novel findings. Finally the usefulness of the present method on genetic engineering has been depicted with an example.

VEGF signaling pathways, which are responsible for angiogenesis for this kind of modularized study, have been partitioned using a modularization algorithm. The sets of modules were compared among themselves to get the best set of modules for an optimal complexity value. The best sets of modules were then compared with those obtained by four different graph partitioning algorithms. This comparison enabled the choice of a good algorithm to create partitions from human VEGF signaling pathway. The best set of modules was obtained from different species for comparative study. Comparison among these modules would shed light on the trend of development of VEGF signaling pathway over these species.

R. K. De

Image Processing/Computer Vision

Performance of a digital image watermarking algorithm, in general, is determined by the visual invisibility of the hidden data (imperceptibility), reliability in the detection of the hidden information after various common and deliberate signal processing operations (robustness) applied on the watermarked signals and the amount of data to be hidden (payload) without affecting the imperceptibility and robustness properties. A new spread spectrum (SS) image watermarking schemes has been developed using discrete wavelet transform (DWT), biorthogonal DWT and *M*-band wavelets coupled with various modulation, multiplexing and signaling techniques. It performs better, considering the simultaneous achievement of multi objectivity like optimal imperceptibility, payload capacity and robustness.

M. K. Kundu

Considering image enhancement as an optimization problem, one genetic algorithm (GA) based and two particle swarm optimization (PSO) based hue preserving and gamut problem free color image enhancement techniques have been developed. The processes were as follows. The contrast of an image was enhanced by parameterized transformation functions, in which the parameters were optimized by GA or PSO. In the first algorithm a weighted combination of four different types of nonlinear parameterized transformation functions was used to produce the enhanced image. Enhanced image was evaluated by an evaluation function which considers AC power measure (contrast), compactness measure, Brenner's measure and the information-noise change measure. Based on this evaluation function different parameters were optimized using PSO. In the second and the third algorithms one local and global information based parameterized nonlinear transformation

function was used. In these cases enhanced image was evaluated by another evaluation function which considered edge strength and entropy as the fitness measures. Parameters used in this transformation function were optimized using GA in the second algorithm and by PSO in the third algorithm. The proposed algorithms were tested on several color images and the results were compared with two other popular color image enhancement techniques like huepreserving color image enhancement without gamut problem (HPCIE) and a genetic algorithm based approach to color image enhancement (GACIE). Visual analysis, detail variance, and background variance of the resultant images were reported. It has been found that the proposed PSO based enhancement methods produce better results compared to other methods.

A. Ghosh

In image processing/vision, texture recognition and face recognition have been developed are very significant because of their wide use in many applications. Algorithms have been developed for texture recognition and face recognition. The algorithm for texture recognition is scale and rotation invariant, while that of face recognition is illumination independent.

S. Biswas

A set estimation based classification scheme for face classes was proposed. Its performance was successfully demonstrated over several face image data bases like ORl, Yale, Feret, and AR. The method has been successfully extended to color image data sets, and videos (both gray level and color). Additionally, it has become possible to create new faces for a face class, and thus providing an alternate scheme for the manifold based method of creating new images. A new method was developed for Kernel PCA in which the polynomial kernel was implemented in a different way. A method for the detection of Major control points in color face images has also been developed. It was found to be computationally more efficient than the existing methods, while retaining the same accuracy.

C. A. Murthy

An approach to video image segmentation was proposed, where spatial segmentation was based on rough sets and granular computing and temporal segmentation was done by consecutive frame subtraction. Then the intersection of the temporal segmentation and spatial segmentation for the same frame was analyzed in RGB feature space. The estimated statistics of the intersecting regions was used for the object reconstruction and tracking.

B. Uma Shankar

Pattern Recognition

Symmetry is an important property that is often observed in nature. A new concept of point symmetry has been utilized for evolving the clusters present in a data set. The clustering problem is posed as one of optimization of one or more cluster validity indexes, thereby leading to the development of single or multiobjective (MO) clustering techniques, respectively. Moreover, a newly defined measure of cluster stability is also incorporated in MO clustering. Genetic algorithm and a multiobjective simulated annealing technique called AMOSA are used as the underlying optimization techniques. The detected clusters need not be convex, as long as they satisfy the property of point symmetry. In another work, differential evolution is used for performing clustering while optimizing several objective functions, for both numerical and categorical data. The proposed methods do not need the a priori specification of the number of clusters. Applications in domains like remote sensing imagery, medical images and gene expression data are presented. Biclustering methods are also studied in the domain of gene expression data in order to identify genes that are co-expressed in a subset of the conditions. In a part of the work, clustering of time series data is investigated using multiobjective metaheuristic search methods.

S. Bandyopadhyay

Distance based clustering algorithms can group genes that show similar expression values under multiple experimental conditions. They are unable to identify a group of genes that have similar pattern

of variation in their expression values. Previously an algorithm called divisive correlation clustering algorithm (DCCA) had been developed to tackle this situation, which is based on the concept of correlation clustering. But this algorithm may also fail in certain cases. In order to overcome these situations, a new clustering algorithm, called average correlation clustering algorithm (ACCA), has been developed, which is able to produce better clustering solution than that produced by some others. ACCA is able to find groups of genes having more common transcription factors and similar pattern of variation in their expression values. Moreover, ACCA is more efficient than DCCA with respect to the time of execution.

R. K. De

A new feature selection algorithm has been proposed based on rough set theory. It selects a set of features from a data set by maximizing the relevance and significance of the selected features. A theoretical analysis has been done to justify the use of both relevance and significance criteria for selecting a reduced feature set with high predictive accuracy. The importance of rough set theory for computing both relevance and significance of the features has also been established. The performance of the proposed algorithm, along with a comparison with other related methods, has been studied using the predictive accuracy of K-nearest neighbor rule and support vector machine on three QSAR, five cancer and two arthritis microarray data sets.

The selection of non-redundant and relevant features of real valued data sets is a highly challenging problem. A novel feature selection method has been proposed based on fuzzy-rough sets by maximizing the relevance and minimizing the redundancy of the selected features. By introducing the fuzzy equivalence partition matrix, a novel representation of Shannon's entropy for fuzzy approximation spaces has been proposed to measure the relevance and redundancy of features. Each row of the matrix represents a fuzzy equivalence partition that can be automatically derived from the given data. It also offers an efficient way to calculate many more information measures, termed as *f*-information measures. Several *f*-information measures have been shown to be effective for selecting non-redundant and relevant features in fuzzy approximation spaces. The effectiveness of the method has been demonstrated on a set of real life data sets and microarray gene expression data.

P. Maji

Accuracy and roughness are used to determine uncertainty associated with the approximation of a set in rough set theory. However in determining these quantities, mainly, the cardinality of a set is always used and never the actual values of elements in the sets. Therefore, distances between the exact set and the corresponding upper and lower approximations can give a better quantitative measure of the roughness. Therefore, a new measure was proposed based on Hausdorff metric, which takes into account the distance between two sets, the exact set and its two approximations (lower and upper). By using this measure the uncertainty of a rough set can be quantified based on the values in the domain of sample points but not on the basis of number of sample points. The proposed roughness measure helps in choosing the partition that gives better approximation of the set under consideration. A new measure was proposed for granulation based on the Hausdorff metric. This has the advantage of distinguishing the two different granularities, better than the existing measures. The effectiveness of the proposed measures was demonstrated on a synthetic data. These measures were helpful in classification and feature selection problems.

B. Uma Shankar

Video Image Analysis

A novel algorithm for moving object detection and tracking has been proposed. The algorithm includes two schemes: one for spatio-temporal segmentation and the other for temporal segmentation. A combination of these schemes was used to identify the moving objects and tracking them. A compound Markov Random Field (MRF) Model was used as the prior image attribute model, which takes care of the spatial distribution of color, temporal color coherence and edge map in the temporal frames to obtain the spatio-temporal segmentation. Here segmentation was considered as a pixel labeling problem and was solved using maximum aposteriori probability (MAP) estimation technique.

The MRF-MAP framework was computation intensive due to random initialization. To reduce this burden change information based heuristic initialization technique was proposed. The scheme required an initially segmented frame. For initial frame segmentation compound MRF model was used for attribute modeling and the MAP estimation was obtained by a hybrid algorithm (combination of both Simulated Annealing (SA) and Iterative Conditional Mode (ICM)) that converged fast. Similarly for temporal segmentation, instead of using graylevel difference based Change Detection Mask (CDM), a CDM based on label frame difference was used and it showed a lower effect of silhouette. Further, combination of both spatial and temporal segmentation process was used to detect the moving objects. Four reference videos were considered to test the effectiveness of the approach. It was noticed that the proposed approach provided a better spatial segmentation compared to some related methods.

A. Ghosh

Change Detection in Remotely Sensed Images

A context-sensitive technique for unsupervised change detection in multitemporal remote sensing images has been proposed. The technique is based on fuzzy clustering approach and takes care of spatial correlation between neighboring pixels of the difference image produced by comparing two images acquired on the same geographical area at different times. Since the ranges of pixel values of the difference image belonging to the two clusters (changed and unchanged) generally have overlaps, fuzzy clustering techniques seem to be an appropriate and realistic choice to identify them. Two fuzzy clustering algorithms, namely fuzzy c-means (FCM) and Gustafson Kessel clustering (GKC) algorithms have been used for this task in the proposed work. For clustering purpose various image features were extracted using the neighborhood information of pixels. Hybridization of FCM and GKC with two other optimization techniques, genetic algorithm (GA) and simulated annealing (SA), was made to further enhance the performance. To show the effectiveness of the proposed technique, experiments were conducted on two multispectral and multitemporal remote sensing images. A fuzzy cluster validity index (Xie-Beni) was used to quantitatively evaluate the performance. Results were compared with those of existing Markov random field (MRF) & neural network based algorithms and found to be superior. The proposed technique was less time consuming and unlike MRF did not require any a priori knowledge of distributions of changed and unchanged pixels.

A. Ghosh

Machine Vision and Perception

Studies have been made on the origin of Mach bands in vision and their charecteristics. This illusion, as we all know, has a checkered history. The Fomm's striae (light and dark) in determining the wavelength of X-ray immediately after its discovery, from diffraction experiments, turned out to be nothing but results of Mach band illusions and a serious mistake in Physics was corrected as early as in 1899. Then in the same year, this very illusion was also found to be the culprit in the well-known discrepancy in determination of earth's radius from its shadow during lunar eclipse and the explanation was finally provided from the angle of physiological optics and perception rather than physical or geometrical optics by H. Seeliger based on Lambert's suggestions. But till now, there is no authoritative explanation of this phenomenon based upon the standard contrast theory or Gestalt theory in vision. In our present work the relation of intensity gradient with the shrapness of Mach bands formed is being studied to arrive at a suitable computational model that may enable us to generate more shades from a fewer number of colours. An interesting application may be in the domain of image compression.

K. Ghosh

Systems Science and Informatics Unit

Geospatial Information Processing and Modelling

Terrestrial Analysis

Developed a morphological approach to compute morphological convexity measures of terrestrial basins derived from Digital Elevation Models. These convexity measures have been compared with a host of available indices such as topological quantities, fractal dimensions.

Spatial Informatics

A morphology-based spatial interpolation technique that was developed earlier is applied to generate a sequence of spatial maps in other potential areas (e.g to simulate flood propagation and flood receding maps etc). While continuing this work, of late, two original algorithms based on mathematical morphology transformations are proposed to: (i) derive strategically significant set within a cluster consisting of subsets (connected components) of varied sizes and shapes (e.g. states in country, water bodies within a biogeographic boundary). This work involves certain basic computations of dilation distances and Hausdorff distances, and length of boundary being shared between origin and destination sets. The potential applications of this work could be foreseen in studies such as spatial planning, facility allocation, and location analysis. (ii) Convert point data into polygonal data via point-specific diffusions (dilations). Point data, for instance, include temperature, rainfall at specific points (e.g. Gauge Stations). Such point data are of with varied numerical values. Higher the recorded value at a specific point (spatial coordinate), larger is its influence over the geographical space. In order to convert such point data available at specific points in to a spatial map with influence zones, a Weighted Skeletonization by Influence Zones (WSKIZ) was proposed and demonstrated for a variety of geographic variables that are both time dependant and time invariant.

B. S. D. Sagar

Computational Neuroscience

Brain signal processing

Fourier coefficients of human scalp EEG have been studied. When signals from two or more electrodes are coming largely from the same source a kind of uniformity among the coefficients has been observed which has been termed as Fourier uniformity, which is a new concept. This has been applied to localize cortical sources of the scalp EEG. A review of various soft computing approaches to human scalp EEG has been undertaken and a paper has been communicated. Deep brain continuous EEG signal of 21 epileptic patients has been studied. A novel differentiation and statistics based algorithm to automatically detect seizure onset and duration has been developed. Multiresolution analysis based on DB4 wavelets is going on. A novel finding has been made regarding the Hilbert transform based phase synchronization is going up in the Gamma frequency band (30 to 80 Hz) towards the end of seizure in a large number of patients.

Behavioral modeling

A mathematical model of tripartite synapses is being developed, where astrocytes mediate information flow from the presynaptic to the postsynaptic neuron. The model consists of a presynaptic bouton, a postsynaptic dendritic spine head, a synaptic cleft and a perisynaptic astrocyte controlling Ca^{+2} dynamics inside the synaptic bouton. This in turn controls glutamate release dynamics in the cleft. As a consequence of this, glutamate concentration in the cleft has been modeled, in which glutamate reuptake by astrocytes has also been incorporated. Finally, dendritic spine head dynamics has been modeled. As an application, this model clearly shows synaptic potentiation in the hippocampal region, i.e., astrocyte Ca^{2+} mediates synaptic plasticity, which is in conformity with the majority of the recent findings. Short term synaptic plasticity is crucial for working memory formation in the brain.

K. Majumdar

Granular Computing Model for Pattern Classification

Granular computing refers to that where computation and operations are performed on information granules (clumps of similar objects or points). The main task to be focused is to construct and describe information granules, which play essential roles in human cognition. Generation of informative granules lead to a better retrieval of information and useful for pattern classification. We are working in the generation of informative granules and information retrieval methods using soft computing techniques. At present, we have developed two models for pattern classification based on granular space. The models use the merits of fuzzy sets, rough sets and wavelet transform, and their hybridization. Further, we are looking into the effective applications of granular computing in web mining.

Saroj K. Meher

Physics and Earth Sciences Division

Geological Studies Unit

Morphology, function and ecology of the Mesozoic non-marine tetrapods of the Gondwana basins of peninsular India.

Since the inception of the geological Studies Unit, the vertebrate paleontologists of GSU have discovered nearly 50 new terrestrial tetrapods from the Mesozoic deposits of the Gondwana basins of Peninsular India. A synthesis on the available data indicates that this spectacular array of vertebrates was deposited chiefly in a fluvial milieu. It has been noted that the maximum numbers of amniote taxa are known from the late Triassic and there was a decline of diversity among the nonamniotes during that period. The richness index of Indian Mesozoic fauna was found to be lower than the South African, North or South American coeval fauna.

Functionally, the temnospondyl amphibians were found to be passive predators with sluggish movements. At least 8 ecomorphs were found to share the Early Triassic semi-aquatic niche in India. The number of temnospondyl ecomorphs diminishes with time and disappears in the Jurassic. However, in middle Triassic they were dominating again in certain ecosystems particularly in the fossil communities of the Denwa Formation, Central India.

D.P. Sengupta

Floodplain facies: A study of litho-facies and geochemistry of the fines-dominated fluvial deposits of the Gondwana successions

In India, a number of Permo-Triassic mud-dominated fluvial successions occur in different Gondwana basins. They provide an opportunity to characterize these inadequately understood fluvial systems and to constrain the climate–tectonic combination that leads to such depositional environments. To achieve that, this study involves sedimentologic and geochemical investigations on an Indian mud-dominated fluvial succession of Triassic age.

P. Ghosh

A systematic study of marine gastropod assemblages from the Jurassic rocks of Kutch, western India with special emphasis on faunal endemism.

A large number of archaeogastropod specimens along with many caenogastropod specimens from different localities of Kutch, western India have been systematically collected. Gastropod assemblages are associated with many time-diagnostic ammonite species, which helps in establishing the high–

resolution chronostratigraphic ranges of the present gastropod faunas. Stratigraphic ranges of many genera have been revised.

Family Pleurotomariidae dominates the archaeogastropod community in Kutch throughout the studied interval (Bajocian to Berriasian). So far 24 pleurotomariid species belonging to five genera have been recognised. Other than pleurotomariids rest of the archaeogastropods are represented by seven families of which six are recorded from the Late Bathonian to Oxfordian time interval. The only family that is recorded from the Middle to latest Tithonian is represented by two new species of the same genus, *Chartronella*.

S.S. Das

Growth and evolution of Meso-Neoproterozoic carbonate platforms in the Chattisgarh and Cuddapah basins, south India: Tectonic and palaeogeographic implications.

Detail facies analysis of siliclastics and carbonates in the eastern sector of the Chattisgarh basin has been completed with emphasis on the non-stromatolitic carbonate platform evolution. The Raipur Group includes two major carbonate platforms separated by calcareous shale. The lower carbonate platform, the Sarangarh platform, comprises a thick succession of apparently monotonous lithographic limestones, completely devoid of stromatolites. It comprises mostly of calci-micrite, with subordinate dolomite at places. Intrabasinal limeclasts edgewise conglomerates and calcareous peloids occur as minor constituents. Facies analysis of the carbonate rocks reveals physical aspects of environmental dynamics, particularly the cyclicity between high energy storm-tidal events and low energy interludes. Facies analysis of the Vempalle platform, a rimmed, dolomitic carbonate platform and the Narji platform, a non-rimmed carbonate platform of the Cuddapah Supergroup was completed during 2008-2011 field sessions.

S. Patranabis-Deb and D.Saha

Geochronological constraints on tectonic assembly and dispersion, in relation to the eastern Ghats Orogen

The two major lithology or gneiss components in the polycyclic granulite terrain of the Eastern Ghats, India, are the supracrustal rocks, commonly described as khondalites, and the charnockite-gneiss. Northern Eastern Ghats belt, north of the Godavari rift has been defined as the Eastern Ghats Province, while that to the south has been defined as the Ongole domain. Many of the workers considered the khondalites as the oldest component with unknown basement and the charnockite-protoliths as intrusive into the khondalites. However, published geochronological data do not corroborate the aforesaid relations. Onset of khondalite sedimentation in the Proterozoic Eastern Ghats Province, constrained by detrital zircon data, as around 1.3 Ga and the charnockite-protolith emplacement between 1.9 and 2.9 Ga, argue against intrusion of felsic magma (tonalite, now enderbite!) in to the khondalites. The field relations of the hornblende- mafic granulite with the two gneiss components together with Sm-Nd isotopic data of the hornblende-mafic granulites (both the xenoliths within charnockites and those interbanded with the khondalites) indicate that khondalite sediments were deposited on older mafic crustal rocks.

Samarendra Bhattacharya, W. Teixeira, M. Basei, A.K. Chaudhary and Rajib Kar

Depositional systems and sequence stratigraphy of the Vindhyan inlier of the Hosangabad-Bhopal area

The Vindhyan succession of the Bhopal-Hoshangabad region is about 500 m thick and stratigraphically lies above the topmost unit of the Son valley region. The succession comprises of a number of 50-100 m thick parasequences stacked dominantly in an aggradational pattern.The different depositional systems recognized were: a) aeolian-aqueous coastal flat, b) tidal flat without any record of eolian activity, c) tide-influenced shoreface, d) storm-influenced shoreface, e) braidplain delta and f) inner shelf.

C. Chakraborty

Sediment transportation and sorting processes in sand-pebble mixture in experimental channel and their geological implications.

Very fine and fine to medium sand was collected from Bakkhali and Chandipur respectively. Heterogeneous pebbly sand used in experiments was produced by mixing medium sand with pebbles. In all experiments a 3-4cm thick bed has been used and then collected velocity data in presence of sediments. The sequences of bedform development were noted and sediment samples were collected from near bed region as well as from different heights (up to 25cm from the bed). Although unimodal very fine and fine to medium grained sand has been used as bed material, bimodal grain-size distribution was obtained in suspended sediments collected from 5 cm above the bed both in the upstream and downstream side of the experimental channel in both cases. This bimodality in grain-size has not been observed in experiments conducted using sand-pebble mixture.

Rajat Mazumder

Quaternary sediments of Himalayan foreland basin

Geomorphology, sedimentology and stratigraphy of selected areas between Munger and Jaldhaka River of the Ganga-Brahmaputra alluvial plain is the selected area for study. One of the major geomorphic forms explored is the Kosi and Tista megafan. Our analysis has shown that the concept of continuous lateral translation of the Kosi River on the megafan surface during last two hundred years is supported neither by any historical data over this period nor by conceptual or simulation models. Finally, near surface sediments from this area yielded OSL date between 500 to 1000 years, validating the predictions mooted out from the conceptual model building in these project. The finding showed existence of multiple lobes in each of the megafans, a continuum of morphology and accretion processes between smaller high-gradient, gravelly alluvial fans and large, sand-mud underlining dominated low-gradient megafans. Simultaneously preliminary examinations were carried out on the Siwalik rocks – the Neogene foreland deposits of the Himalaya for a comparison with the modern foreland basin deposits

T. Chakraborty

Surface, Colloid and Environmental Sciences

The microstructures of reverse micellar systems comprising anionic surfactant (AOT) and nonionic surfactant (Tween-85) in biocompatible oils of different chemical structures and physical properties [ethyl myristate (EM), ethyl palmitate (EP), ethyl oleate (EO), isopropyl myristate (IPM), isopropyl palmitate (IPP)] at 303K (in absence of additives) have been characterized as a function of water content (ω) at different mole fractions of Tween-85 ($X_{Tween\text{-}85}$) at 303K by conductivity measurements at a total surfactant concentration S_T=0.1mol.dm^{-3}. Most of these systems exhibited percolation in conductance depending on the oil type and content of Tween-85 ($X_{Tween\text{-}85}$). It has been observed that threshold value of volume-induced percolation (ω_p) decreases with increasing content of Tween-85 ($X_{Tween\text{-}85}$), total surfactant concentration (S_T). Percolation threshold (ω_p) also varies not only with molar volume of oil but also with chemical structures of oil, which contains different ester group

The conductivity data have been analyzed to estimate the energetics of clustering (i.e., ΔG^0_{cl}, ΔH^0_{cl} and ΔS^0_{cl}) for these systems with varying different physico-chemical conditions viz., water content (ω), content of nonionic surfactant ($X_{Tween\text{-}85}$), total surfactant concentration (S_T) and nature of oils.

Bidyut K. Paul and Kaushik Kundu

North-East Project: Thrust sequences, cross faults and fault zone rocks in the Eastern Himalaya: partitioning of ductile displacements and brittle fault slips

Along strike variation in Main Central Thrust (MCT) architecture and Lesser Himalyan Geology in Sikkim and Arunachal in Eastern Himalaya, has been reassessed and explained by greater

syntectonic uplift and erosion in Arunachal Pradesh compared to Sikkim, which led to exhumation of the Ziro granite gneiss to shallower levels. The thrust sheet bearing Greater Himalyan Crystallines was tectonically transported over the Ziro gneiss as the thrust system evolved over time. An out of sequence movement on the MCT is assumed in this interpretation. However, greater convergence rates in the eastern Himalaya may have led to larger mid-upper crustal thickening due to stacking of thrusts over the MBT and MCT, which in turn could have positive feedback on topography in the Lesser Himalaya.

Dilip Saha and Sankha Das

Phase-II: MCT architecture and fault zone kinematics with reference to Lumla "window" in northwest Arunachal Pradesh and other comparable outcrops

On the basis of overall similarity of lithostratigraphy, the metsedimentary sequence around Lumla in the Higher Himalaya has been tentatively equated with the Proterozoic Dirang Formation of the Lesser Himalaya in northwestern Arunachal Pradesh. Recent mapping in the area has shown that the Lumla sequence is structurally bounded on the top by a major thrust with tectonic transport to the south, comparable to the MCT. This bounding thrust is folded over a major E-W antiform in the Higher Himalaya of western Arunachal Pradesh. The Lumla sequence shows strong internal deformation comparable to that inside a thrust sheet.

Dilip Saha

Physics and Applied Mathematics Unit

Astro Optics

Analysis of PAHs extinction efficiencies to prepare an analytic framework for study of inter Stellar Extinction data corresponding to Galaxies like the Milky way, SMC, LMC was carried out. This work is covered under an ISRO project.

A.K. Roy

Bayesian Approach to Data Analysis in Astronomy

Attempts have been made to study the relation between the apparent magnitude and the redshift based on the data set from SDSS quasar catalogue. This sheds new light on the validity of Hubble law for high redshift. The cluster analysis is under investigation for this kind of quasar data.

Sourabh Bhattacharya, Sabyasachi Mukhopadhyay and Sisir Roy

Classical Optics (Scattering)

Analytic modeling of small particle size-distributional PHASE function has been done to extend our earlier single particle formula. The results are expected to be of practical use in the study of scattering of light from soft, tenuous media collaborator.

A.K. Roy

Cosmology

New models of cosmological inflation have been proposed in the framework of background super-gravity. This involves construction of the inflation potential from super-gravity and analysis of the typical energy scale of inflation, which resonates well with present estimates from cosmology and standard model of particle physics. Further, a careful investigation of cosmological perturbations have been performed, which leads to exploring observational aspects related to Cosmic Microwave Background (CMB) radiation. It has been demonstrated that this semi-analytical treatment reduces complications related to numerical computation to some extent and may even result in increased accuracy level for studying the features of different phenomena related to CMB angular power

spectrum, which can be useful in precision cosmology to confront with the existing and upcoming observational data.

On the other hand, the generalized particle dynamics, proposed earlier, have been employed to model dark energy, which accounts for the late acceleration of the universe. An effective dark energy equation of state, exhibiting a phantom like behavior, is generated. The results have been confronted with present day cosmological data coming from high redshift Supernovae. The constraint structure of the recently proposed Horava gravity regarding the existence of extra mode has been considered. It has been shown that in weak gravity the problem is absent. Furthermore a scheme has been provided for gauge invariant extension of Horava gravity.

S. Pal, S. Ghosh and B. Basu

Foundations of Quantum Mechanics & Theory of Measurements

A framework has been developed where partial reduction of wave pocket is considered depending on certain conditions. The connection with weak measurements as proposed and developed by Aharanov et al is under investigation.

S. Roy

High and Ultrahigh Energy Physics

The Large Hadron Collider (LHC) started its actual experiments since November 2009. But, to date, no significant results arousing new wonder(s) were reported. On the contrary, the experimental reports emanated from the RHIC-BNL-TEVATRON, SPS, and ISR etc. are much more meaningful, and at the same time, more reliable after repeated confirmation with very high statistics experiments. As a result, our attention over the last one-year was, in the main, focused by the model-based analyses - both intensive and extensive - of the vast amount of very important data on the rapidity spectra of the various particles produced in both particle-particle and particle-nucleus and nuclear collisions. This objective is now fulfilled by nearly completing the assigned task from the viewpoint of a newly built-up model by us. Besides, the behaviour of the p_T – spectra in Cu-Cu interactions at very high (RHIC) energies was studied in detail in the light of an established non-standard approach. Furthermore, the characteristics of ‘soft’ particle production in very heavy nucleus – nucleus collisions at extremely high energies were exhaustively studied and discussed in a substantial work of great merit. The chain of works highlights the importance of some useful alternative approaches.

S. Bhattacharyya

Planck Scale Physics and Cellular Network Theory

Cellular Network Theory has been proposed to understand the space-time at Plank Scale. Kind of selfsimilar processes are supposed to be involved in the emergence of space-time around. With the help of agent-based simulations we are able to produce continuum space-time starting from discrete structure. The result has been published in a research monograph jointly with Prof. Ralph Abraham.

S. Roy

Plasma Physics

Large amplitude dust ion acoustic solitary waves and double layers in complex plasma with non-isothermal electrons have been studied and critical values of some plasma parameters, beyond which solitary solutions would cease to exist, were obtained.

R. Roychoudhury

Quantum Control, Interacting Fock Space and Boson Fock Space

In continuation of our development of studies in interacting Fock space It was observed that starting with the interaction of interacting field and a two level atom the atom-interacting field system acquires

a space parameter dependent Berry phase after the phase parameter slowly changes and ultimately returns to its initial form.

In fact, geometric phase will be applied to implement the fault-tolerant quantum gate which shows its importance in physical application.

We are also in the process of generating W state with the help of designing QED baths connected in parallel with the help of state space representation in stochastic field of the optical QED by developing quantum feedback QED control system.

P.K. Das

Quantum Information Theory

Recently a new principle, namely 'information causality principle' has been discovered and this is stronger than no-signaling principle. This new principle exactly reproduces the Trielson's bound for optimal violation of Bell's inequality in quantum mechanics. In the context of information causality condition, the Hardy's non-locality has been studied and compared to all the corresponding results under no signaling condition and those in quantum mechanics. Simulation of quantum correlation by signaling correlation with binary input and binary output has been studied and a complementary relation between local randomness and communication has been found. The result for simulation has also been extended to more general spin measurement. Local Hidden Variable theory has been provided for measurements of un-sharp spin observable on a singlet state with some restrictions on the un-sharp parameters.

Recent investigations have revealed that there exist quantum correlations other than entanglement. One such is the quantum discord, which basically quantifies the total non-classical correlations in a quantum state. The geometric measure of entanglement and quantum discord have been calculated analytically for arbitrary superposition of two N-qubit GHZ state. Quantum discord for the W state has also been conjectured.

G. Kar and P. Parashar

Quantum Mechanics

A new class of polynomials, called the exceptional orthogonal polynomials (EOP), has been studied in details and various properties of these polynomials have been found out. Also information entropies and different measures of uncertainty associated with the models (whose solutions are given in terms of EOP) have been studied. Using quantum mechanical techniques some results related to option pricing have also been obtained.

Entropic origin of gravity, as suggested by Verlinde, is a new area of intense research. It has also been extended to quantum regime through Heisenberg Uncertainty Principle. We have considered effects of Generalized Uncertainty Principle in the context of holographic gravity.

Quite recently, the prospect of realizing complex PT symmetric potentials within the framework of optics has been suggested. These optical PT symmetric potentials can lead to behaviors, which are impossible in standard quantum mechanical systems. For example, it has been shown that there exists more than one exceptional (critical) point for a particular PT symmetric optical potential.

The effect of position dependent mass profiles on dynamical breaking of N – fold supersymmetry in several type B and type X_2 models whose wave functions are given in terms of exceptional orthogonal polynomials, has been investigated. It was found that some physically relevant mass profiles can change the pattern of dynamical N-fold supersymmetry breaking in trigonometric, hyperbolic, and exponential potentials of both type B and type X_2. The latter results open the possibility of detecting experimentally the breaking of N-fold as well as ordinary supersymmetry at a realistic energy scale.

Non-isopectrality of the generalized Swanson Hamiltonian and Harmonic Oscillators has been studied in a position dependent mass frame when the mass function takes some particular functional forms.

P. Roy, S. Ghosh, B. Roy, R. Roychoudhury

Quantum Tunneling for Dissipative System

The stability of the solutions of Schrodinger Langevin equation has been studied using the concepts of non-linear dynamics. The tunneling time has been estimated for dissipative system based on quantum Langevin approach.

Sisir Roy, S. Bhattacharya and S. Dutta

Theoretical Condensed Matter Physics

The dynamics of quantum phase transition induced by a quench in different one-dimensional spin system has been studied. The dynamical mechanism of Kibble Zurek has been followed to show the role and importance of geometric phase in the study of quantum critical phenomena. The entanglement properties of these systems in the vicinity of the critical points have also been investigated.

B. Basu andP. Bandyopadhyay

Transport of contaminants in rivers and its possible application to biological fluid dynamics

The stream-wise dispersion of tracer materials released in an oscillatory flow through an annular pipe with reversible and irreversible reactions has been studied analytically using a method of homogenization. Numerical simulations have also been performed to investigate the dispersion of passive contaminants released in time-dependent flows through conduits in presence of boundary absorption at the wall, which causes a depletion of contaminant in the flow. The contributions have great relevance due to its application for dispersion of tracers in cardiovascular system and environmental fluid mechanics.

B. S. Mazumder

Integral Equations

Numerical solution of weakly singular integral equations was obtained using Bernstein polynomials as basis. Evaluation of singular integrals was carried out using Daubechics wavelets and used in numerical solution of singular integral equations.

B. N. Mandal

Water Waves

The water wave problems were tackled involving transmission of water waves through apertures in a pair of thin vertical barriers, construction of wave free potentials, Cauchy-Poisson problem in sloping beach, generation of waves due to disturbances on the bed of a beach sloping at an arbitrary angle, source potential due to higher order boundary conditions.

B. N. Mandal

Turbulence characteristics associated with bedforms

Turbulent flow over bedforms structures and understanding its impact on sediment movement has been studied**.** The novelty of this work is the collection of velocity data over successive fixed asymmetric dunes in an experimental channel and investigation of the evolution and development of turbulent boundary layer over successive dunes. Moreover, one pioneering result had been achieved that *'*secondary points of separation' at the bifurcation points of shear layer over a series of dunes were discovered, the well known primary points being at the crest of dunes. The secondary points of separation vanish when surface waves are superimposed. The superposition of surface waves on the

unidirectional flow leads to increase in the apparent bottom roughness, which causes resistance to flow as well.

Flow visualization and image processing

To understand the sand grain sorting process at the riverbed, High-Speed Motion Scope Camera (1000fps) available at the ISI laboratory has been used to record the motion-picture photography of the particle movement of different sizes at near-bed turbulence. The imaging technique was used to characterize the particle motion, displacement and angle of orientation and their trajectories, and their interactions with the rough boundary. The important phenomenon observed in this study is that the fluctuations of angle of orientation of any particle follow statistically the Gaussian distribution, which may be closely related to fluctuating shear stress.

Turbulent Flow over obstacle marks

Local scouring around an obstruction in the river bed is a result of the interaction between the local flow field inducted by the obstruction and the river bed. An immovable obstruction, such as, a pipeline placed at the sand bed, restricts the area of flow in a stream channel. Water piles up against the upstream edge of the obstruction, causing an increase in velocity around the sides, accompanied by the development of vortices. Scour marks may develop, and the scoured-out material may be deposited downstream as a sand bar. The obstacle marks named as current crescent preserved in geological record are traditionally used as an indicator of palaeo-current direction. The formations of obstacle marks are available in cross-bedded sediments depending on the orientation and plunge of the long axes of the pebbles.

B. S. Mazumder

Information Processing in the Brain

The information processing in the brain has been studied within the framework of dynamic probabilistic geometric framework. Fisher measure has been shown to be the appropriate measure for this kind of information processing. Noise plays a significant role in brain function. We have studied the cancellation of noise in cognition based on the principle of least time.

Sisir Roy, Rodalfo Llinas and Daniel Bennequin.

Systems and Control Theory

Numerical methods have been developed to design controller for input-output decoupling of descriptor variable system. Stability of the closed-loop system has also been ensured. Matrix second-order systems arise frequently in the formulation of dynamic systems in classical mechanics, robotics, aerodynamics and many others. Obviously, future area of work would be to design observer/controller for Matrix second-order system.

S. Gangopadhyay

Biological Sciences Division

Agricultural and Ecological Research Unit

Introducing Tropical Sugar Beet `TSB` (*Beta vulgaris* L.) in West Bengal: A Study on Yield Performance

Tropical Sugar Beet “TSB” cultivars are developed that led to extension of its area of cultivation commercially. Some of the states in our country have already started commercial cultivation as a raw source of bio-ethanol and replacing the traditional sugar crop, sugar cane. The production of ethanol from this crop is still not attempted. We intend to develop and modify the technology, namely, “Solid Phase Fermentation” in our laboratory and we would like to observe the variation between the varieties

for producing ethanol in a particular growth stage. Nitrogen plays dual role on this crop; it has a positive relation with root yield and has a negative relation with sugar concentration, which can be checked only through potassium supplement with appropriate doses. We find out from our earlier experiments that out of thirty-six different N:P:K fertilizer combinations, the best combination varied between N150-200, P60-100 and K100-150 kg/ha. In 2009-10 experiment we find out 6 varieties of "TSB" namely SANDRINA, ARRIBA ESPERANZA & CAPITANA from JK Agric Genetics Ltd Hyderabad and INDUS & SHUBHRA from Syngenta India Ltd. Pune, performed well. This year (2010-11) we are trying to find out more suitable varieties along with their optimum fertilizers doses at different location of North 24 Pgs. Various agronomical aspects like spacing, date of sowing, harvesting dates and variations in sugar concentration should be kept in account to fit in an appropriate design of experiment for the new varieties. We are trying to extend our experiments in other farms also located at different places of north 24-parganas as well as at farmers field at different locations of different districts for adaptability and yield performance test of new "TSB" varieties. This year in our Institute Agric. Experimental Field sowing has already done in the month of November in 4 plots out of 6 plots and at Gaighata field sowing is going on.

S. Barik

Nanobiotechnology: Applications in Agriculture and Veterinary Sciences

Nanoscience is expected to revolutionize agriculture and veterinary sector in coming years. Researchers in ISI have developed three kinds of nanosilica particles which showed entomotoxic properties against stored grain pests and mustard aphids. Silica nanoparticles also showed anti-viral properties against *Bombyx mori* nuclear polyhedrosis virus (BmNPV) and thus would be able to protect commercial silkworm from this 100% deadly virus. Two forms of Nanosulfur developed by ISI researchers have showed excellent antifungal properties against *Aspergillus niger* (common food pathogen) and *Fusarium sp*. Aforementioned nanoparticles have been patented with Department of Biotechnology (DBT), GOI.

A. Goswami

Integrated Nutrient Management for Sisal cultivation in laterite soil of Girdih, a Sub-Tropical Plateau Region of India

Sisal (*Agave sisalana* Perrine) is a perennial leaf fibre producing annual plant, can tolerate prolonged drought and high temperature (up to 45°c). The fibre is commercially used for making strong ropes, cordage, twines, coarse fabrics, rugs, carpets, handicrafts, mats, fishing nets, etc. The leaf pulp is used in specialty paper products such as tea bags, plug wrap and surgical gauze. The cultivation of this plant provides working opportunities of local people during off-season of draught prone areas. The study is in progress on the following areas:

i) The impact of fertilizers on growth of the plant.
ii) Intercropping with pulses, oilseeds and elephant foot yam.

M. Ghose, B. Sarkar and R. Dasgupta

Mycorrhizal status of Mangroves of the Sundarbans

Arbuscular Mycorrhizal (AM) fungi increase soil fertility and act as potent soil binders. The present investigation may help in ecological management of Sundarbans mangroves in West Bengal and other similar ecological niches. The study is in progress on the following areas:
(i) Estimation of mycorrhizal colonization of mangroves and mangrove associates of different islands of the Sundarbans.
(ii) Distribution of vesicular arbuscular mycorrhizal (VAM) spores in the rhizospheric soils of mangroves.
(iii) Effects of physico-chemical properties of soils and tidal inundation on the mycorrhizal status.

M. Ghose

Research Activities

Monitoring of pond biodiversity to assess the ecological status of ponds

Water samples and plant data from about 100 ponds, varying in size from 0.01 to 1.10 hectares, in the Baranagar area is almost complete. Presence/ absence of individual aquatic vegetation species in each pond along with the associated flora (not true aquatics) was extensively studied to get an idea about species diversity. Commonly occurring species were *Alternanthera, Ipomoea, Eicchornia* and *Lemna*. In this study, only one submerged species could be observed which is alarming since submerged plants are known to maintain water clarity. With regard to water quality, turbidity values ranged from 0.6 to 77.2 NTU, dissolved oxygen values ranged from 0.1 to 14.0 mg/l and total phosphorus values ranged from 0.08 to 6.17 mg/l showing great variability between ponds.

Anjana Dewanji, P. K. Ghosal, C. Medda, Anup Dewanji and D. Sengupta

Development of new Agrochemicals from plant allelochemicals and their possible implication in Agricultural practices

Natural agrochemicals play a significant role in Agricultural systems that seek to reduce the input of synthetic chemicals and conserve natural fauna. Identification of strong bioactive allelochemicals is a useful source for the development of biological herbicides and pesticides. Allelopathic interactions in certain tropical plants namely *Tamarindus indica, Tectona grandis, Leonurus sibiricus, Chrozophora rottleri, Artocarpus lakoocha, Cleome viscosa, Piper chaba etc.* have been studied and isolated and identified some of the allelochemicals involved in this process and their mode of action. Lactam nonanoic acid [2-amino-9-(4-oxoazetidin-2-yl)-nonanoic acid]have been isolated from the root exudates *of Cleome viscosa,* which is responsible for both allelopathic and medicinal properties of that plant. Strong biopesticidal compounds have been extracted and identified from *Tamarindus indica* and *Tectona grandis*. A broad spectrum bacteriocide have been recovered from *Artocarpus lakoocha.* These results indicate the possibility of using bioactive allelochemicals extracted from plants as biofertilizers and biopesticides. These are eco-friendly and may replace such synthetic agrochemicals that often lead to environmental hazards.

S. Mandal Biswas and S. Chanda

Determination of functional response under selective predation through experimentation and modeling

Selectivity is common in predator-prey interaction but the selection mechanism is still unexplored and a debatable issue in modern theoretical and experimental ecology for numerous species across the globe. In context of the current project we undertake an experiment to judge the feeding selection of a zooplankton through performing a feeding experiment in a restricted and controlled environment in the lab. As a test bed we select one nontoxic phytoplankton (*Chaetocerous gracilis*), one toxic phytoplankton (*Microcystis aeruginosa*) and one zooplankton (*Artemia salina*). Initially the experiment is setup through the small batch cultures of Nontoxic (NTP) and toxic Phytoplankton (TPP). Both the strains of phytoplankton are collected from the deltaic region of river Subarnarekha (87°31”E and 21°37”N) and the isolation is done in the laboratory. Similarly batches of zooplankton (Brand: Red Top, USA) are also hatched and maintained at optimal conditions in the laboratory. To evaluate our hypothesis in restricted environment we have introduced the zooplankton in a 3 liter beaker with 75: 25 (TPP: NTP) food ratio. Biological activities (feeding) are monitored for each of the species with regular recorded biomass count on each experimental day till the predator population goes to extinct (Pal. et.al, 2010). Initial results revealed considerable mortality of predator population only when TPP is alone present in the system while in presence of small NTP the predator population survives. It also indicates a clear preference of the Zooplankton towards more safer and larger food particles in restricted environment.

J. Chattopadhyay

Chemical and Microbiological Studies on Haritaki (*Terminalia chebula* Retz.) against Uropathogenic *Escherichia coli*

In recent years multiple drug resistance has developed due to indiscriminate use of existing antimicrobial drugs in the treatment of infectious diseases. This resistance problem demands that a renewed effort should be made to seek antibacterial agents form other sources effective against pathogenic microorganisms resistant to current antibiotics. One of the possible strategies towards this objective is the rational localization of bioactive phytochemicals. *Terminalia chebula* (Combretaceae) is a great herb with lack of extensive research studies and is always listed first in the list of Ayurvedic Materia Medica due to its extraordinary power of healing. Studies conducted in our laboratory revealed that *Terminalia chebula* fruit extract possessed strong antibacterial activity against multidrug resistant uropathogenic *Escherichia coli* and also showed synergistic activity in combination with selected antibiotics against the test isolates. Bioassay guided fractionation study revealed that Ethyl acetate fraction was the most active fraction and contains high content of phenolic compounds that are responsible for this activity. These promising findings could be considered as a valuable support in the management of urinary tract infections and may contribute to the development of new and safe antimicrobial agents from *Terminalia chebula*. Further studies are in progress

R.R. Chattopadhyay, A. Bag and S.K. Bhattacharyya

Management strategies for rice cultivation in the eastern plateau: Ethno-scientific, field experimental and crop modeling approaches

Weather is the most important input in agriculture. The potential of climate as an agricultural resource has not been used or even realized by the scientific community even though it has sometimes been observed that rice cultivators have their own perceptions. As a result, several crops are grown traditionally without considering the suitability of the climate leading to poor yield and thus much of the production potential of this vast resource is left unutilized. The objective of this project is to evolve appropriate management options in subsistent rainfed rice based farming systems of Eastern plateau. We have already collected the meteorological data and also we are conducting experiments on rice and wheat production technology. Survey work will be initiated within February 2011 to know the farmers perception on agriculture and above all a novel mathematical/statistical model will be developed to predict the crop yield at micro level.

P. Banik and J. Chattopadhyay

Development of information on agricultural and horticultural production and their marketing using RS and GIS in some districts of West Bengal

The digital data on natural resources, land use pattern and local *hats* and agricultural marketing system (spatial & attribute) generated using RS and GIS tools can also be considered as the base line for the future of e-marketing or geo-marketing system of West Bengal. With this backdrop, four districts of west Bengal have been selected to study the local *hats* and market and their accessibility for marketing the agricultural and horticultural produces. An approach has been adopted to integrate the primary household and market survey data with the spatial data (thematic maps of the districts, maps of local markets etc) to develop an in-depth market information system using RS & GIS tools. Natural resource inventory of the above said districts has been completed and the household and market survey has been initiated under the externally funded project in collaboration with WBSCST, West Bengal.

P. Banik

Study of Molecular Genetic Diversity of some degraded Mangroves of Sundarbans

The aim of this project is to study the intra-specific genetic polymorphism of some degraded mangroves from western Sundarbans of different geographic locations. It is necessary to examine how genetic variation in natural population may vary across different geographic and different climatic areas either by biochemical or genetic (isozyme and DNA) markers. Data collected from different islands of

Indian Sundarbans. Enzyme analyses were carried out (Two antioxidant enzymes – Peroxidase and Super-oxide dismutase and two hydrolyzing enzymes – Esterase and Acid Phosphatase) both qualitatively and quantitatively. The expressions of all enzymes were different across the differential substrate salinity and these polymorphic expressions of the studied enzymes could be properly explained along with the substrate salinity level and varied adaptibility of the investigated plants. DNA isolation was performed from the selected mangrove species (namely *Aegialitis rotundifolia*, *Bruguiera gymnorrhiza*, *Excoecaria agallocha*, *Heritiera fomes* and *Xylocarpus mekongensis*. PCR based technique was adopted with RAPD marker to elucidate their extent of DNA polymorphism. Inter Simple Sequence Repeat (ISSR) marker will be used for more precession of the polymorphic nature within the species.

S. Das

Biological Anthropology Unit

Identification of susceptibility genes and epigenotypes with Polycystic Ovary Syndrome (PCOS) among Indian women

The study aims to indentify candidate genes implicated in various physiological pathways involved in the etiology of PCOS. Blood samples from 250 PCOS cases and 299 controls have been collected. PCR and Genescan analysis of CAG repeat polymorphism of the Androgen Receptor gene has been completed and further X-chromosome Inactivation analysis has also been carried out.

B.M. Reddy

Diet, Activity and Aging: A Prospective Study among the Elderly of Kolkata

The present study aims to evaluate age related variations in respect of selected biological/health characteristics (both physical and mental), among a group of elderly male and female. Analyses of data revealed that cardiovascular risk factor viz., hypertension, hyperlipidemia pose considerable problems. Many other dimensions of health, physical and cognitive functioning, however, remain indicative of successful aging for a large proportion of educated Bengali elderly inhabiting the Salt Lake City, Kolkata.

B. Mukhopadhyay

Genetic epidemiology of malaria and prevalence of HbE in north-east regions of the country

The molecular genetic study of the HbE and its association with malarial prevalence is expected to help understand the variable expression of the disease and the mechanism of population genetic principles. The present study aims to investigate the natural selection of linkage among disequilibrium of the HbE variant in relation to the prevalence of malaria in north-east region.

T.S. Vasulu

Weight related behaviours among urban adolescent girls: an exploratory study

Nowadays the concept of beauty is based on the thinness of body among urban youths especially the girls. This may induce a change in their dietary behaviours which may prove deleterious for their health. The present study evaluates the prevalence of weight concern and subsequent eating behaviours. Data are being collected on perception of body image, eating attitude test (using EAT questionnaire), mental health measures like Beck's depression scale, Rosenberg self-esteem scale and so on from adolescent girls aged 15-19 years.

S. Mukhopadhyay

Human Genetics Unit

Genomic Studies on oral cancer

(a) Study of SNP at apoptosis genes: Apoptosis is an important cellular process that is often compromised in cancerous cells and change in the expression of apoptotic genes has been observed in several cancers. Polymorphisms in the genes of apoptotic pathway have been associated with several carcinomas including oral squamous cell carcinoma. For this study, 109 tagSNPs of 26 apoptotic pathway genes in 1316 individuals (538 controls, 253 leukoplakia and 525 cancer patients) were genotyped and tested for genotypic and allelic association among control, leukoplakia and cancer samples. Genotyping was done on Illumina Golden Gate platform and the data were analyzed using PLINK. After necessary pruning of the data; age, sex, tobacco dose adjusted, multiple testing corrected P-values were calculated using logistic regression. To guard against false association resulting from population stratification, principal components were used as covariates in the regression model. Eight SNPs in eight different genes were found to be significantly associated with the disease. Of these, rs511044 in CASP1 and rs1473418 in BCL2 showed significant association in all the three case-control groups (control-leukoplakia, leukoplakia-cancer and control-cancer). To our knowledge this is the first study to report an association of these two SNPs with any cancer. Also, this study furthered our understanding of the genetics involved in the progression of oral cancer through pre-cancerous leukoplakia stage.

(b) Misgenotying due to mismatch primer: A large-scale misgenotyping was observed when heterozygotes at *NAT1* Single Nucleotide Polymorphisms (SNPs) (rs1057126 and rs15561), determined by Taqman method, were cross-validated by sequencing method using single nucleotide mismatch primer. The same primer, without mismatch, determined correct heterozygous genotype. Highest (100%) and lowest (0%) misgenotyping were observed when the mismatch was at the 3rd and 15th nucleotide positions from 3' end of the primer, respectively. This indicates a relationship between position of the mismatch and frequency of misgenotyping. Homozygotes can be genotyped correctly irrespective of mismatch position in the primer. Similar results were observed for two other SNPs (rs12947788 and rs12951053) at *TP53* in a different sequence context. The possible explanation could be that a single nucleotide mismatch within a primer amplifies only one allele of the heterozygote and, thus, homozygote is obtained in the sequencing chromatogram. It may be concluded that, along with the other PCR conditions, perfect matching of primer with template strand is a key issue to get correct genotype. So care should be taken to design the primer from the template sequence where SNPs is/are absent. The importance of the work lies on the fact that misgenotyping may occur if mismatch primers are used unintentionally due to the presence of SNP(s) and may lead the work to report faulty allele or genotypic frequency.

B.Ray

Genomic Studies on cervical cancer

(a) HPV16 viral load and expression of viral oncogene E7**:** HPV16 is the major viral isolate identified in cervical cancer (CaCx) cases in India. Other than the significant role of viral E2 gene-disruption, viral DNA load is also likely to influence the risk of CaCx development. The objective of this study was to investigate the role of HPV16 viral load and oncogene expression in cervical cancer pathogenesis. A case-control study (152 CaCx cases and 87 controls, all HPV16 positive) was undertaken to estimate viral load and detect E7 and E4 expression by APOT assay combined with quantitative Real Time PCR (TAQMAN). Median HPV16 viral load (Mann- Whitney U test) was significantly higher among cases (2.99x107) compared to controls (1.92x104), irrespective of viral E2-status ($p<0.001$). Logistic regression of log viral load against disease status confirmed the finding both independently [ORage-adjusted=1.261; 95% CI=1.161-1.369; $p<0.001$] and with E2-status as a co-variate of disease-risk [ORage-adjusted=1.333; CI=1.207-1.472; $p<0.001$]. mRNA expression was studied on a subset of 40 cancer samples. APOT cum TAQMAN analysis revealed 23 intact and 17 disrupted samples based on E7 expression in both intact and disrupted while E4 expression in only intact samples. The median viral load significantly varied ($p=0.011$; Mann-Whitney U test) between intact (2.55x107) and disrupted

(9.96x105) samples. Both E7CT/β-actinCT and E2CT/β-actinCT were negatively correlated with viral load ($p=0.016$ and $p=0.002$, respectively) among intact samples. No association ($p=0.899$) was found between viral load and E7CT/β-actinCT within disrupted samples. Mann-Whitney U test showed no difference ($p=0.138$) in median β-actin expression levels between the intact (median β-actinCT =33.19) and disrupted (median β-actinCT =35.31) samples. A significant ($p<0.001$; t-test) difference in the mean E7CT between intact (6.69 ± 8.94) and disrupted (25.69 ± 14.31) samples was observed. Thus association of high viral load with HPV16 positive cases, specifically those having intact E2, and higher E7 expression among E2-intact samples provide novel insights into disease pathogenesis.

(b) miRNA expression and HPV16 related cervical cancer pathogenesis: Deregulation of miRNA expression has been discovered in a wide variety of tumors and it is now clear that they contribute to cancer development and progression. MicroRNA (miR 21, miR 143, miR 196b & miR 16) expression variability in HPV16 positive cervical cancer tissues harboring either E2 intact and/or E2 disrupted viral genomes was determined by Taqman based real-time PCR, using RNU6B expression as the internal control. MiR-21 expression was significantly higher among E2 intact cases (1.83 fold) compared to E2 disrupted cases and miR-143 expression was significantly lower in E2 disrupted cases (3.36 fold) compared to E2 intact cases. Our observation probably reveals that HPV16 E2 disruption in cervical cancers might be associated with a lower differentiation status and metastatic ability of malignant cells in such tissues, attributable to down-regulation of miR-143 and miR-21, respectively, as reported in others cancers and subject to further confirmation.

S. Sengupta

Statistical Genomics

The focus of these studies is to critically analyze existing statistical methodologies and to develop new methodologies for human genetics, especially for gene-mapping, genotype-environment interactions and human evolution.

Statistical Methods for Analysis of Complex Traits

The focus of these studies is to critically analyze existing statistical methodologies and to develop new methodologies for human genetics, especially for gene-mapping, genotype-environment interactions and human evolution.

Statistical Methods for Analysis of Complex Traits: Some novel statistical methods have been developed for linkage and association analyses of complex genetic traits. These include:

(a) Analytic and empirical comparison of population-based case-control studies and the family-based TDT.
(b) Evaluation of effects of population stratification on association analyses of population-based quantitative trait data.
(c) Developing a regression-based method for linkage mapping of multivariate phenotypes.
(d) Developing KBAT-based method for quantitative traits using genotype similarity between individuals in a case-control study.
(e) Developing a test for joint effect of two loci in a case-control association study.
(f) Permutation based calculation of p-values for the new method developed for detecting interaction between loci.

Analyses were performed on:

(a) Type 2 diabetes and related quantitative precursors.
(b) Major psychoses phenotypes including bipolar disorder and schizophrenia.
(c) Cardio-vascular Disorder with emphasis on homocysteine levels.

I. Mukhopadhyay

Social Sciences Division

Economic Research Unit

The scientific workers of the Unit are extensively involved in research, teaching, training, consultancy and academic administration. The research activities are carried out both at individual and collaborative/interdisciplinary levels. These include theoretical and empirical research in diverse areas such as agricultural economics, applied and theoretical econometrics, game theory and application, industrial organization, environmental economics, inequality, poverty and welfare, international economics, econophysics, development economics, political economy, polarization and conflict, mathematical finance, financial econometrics, gender inequality, social indicators of development, decentralized planning and macroeconomic problems of Indian economy. Some details are given below

Increasing Returns, Non- Traded Goods and Wage Inequality

This work focuses on the role of non-traded goods in generating symmetric movements in skilled to unskilled wage ratio in a model of trade. Consumers have quasi-linear utilities and the traded good is produced under increasing returns to scale in a monopolistically competitive market structure. Alternative scenarios are considered. First, the case, where the supply of skilled and unskilled labour is inelastically given, starkly brings out the fact that trade can, through a very natural route, raise wage inequality in both the trading countries. Second, the case, where unskilled labour is tied down to unskilled job but skilled labour can potentially be employed in both the skilled and unskilled job, besides holding the possibility of generating symmetric increase in skill premium in both the trading countries, also demonstrates that trade can help increase utilization of under utilized skilled labour; a result very much in the spirit of Myint's "vent for surplus". Third, introducing the possibility of accumulating skill by incurring a cost it is shown that skilled to unskilled wage ratio can increase in both the trading countries, alongside, trade leads to higher skill acquisition.

Brati Sankar Chakraborty and Abhirup Sarkar

Trade and Wage Inequality

The study shows that with increasing returns international trade would increase skilled wages in all trading countries keeping unskilled wages unchanged. This general phenomenon may either work through a vent for surplus or through additional skill formation. The net result, however, is an increase in wage inequality.

Abhirup Sarkar and Brati Sankar Chakraborty

Trade under Uncertainty

The study looks at the effect of opening up to the world market of the agricultural sector where output is uncertain. It is found that there are cases where free trade is worse than autarky but restricted trade is better.

Abhirup Sarkar and Debasmita Basu

Effect of Reservation on Educational Attainment

Does reservation of jobs increase the incentive to spend more on education or does it discourage such spending? Attempt is made to answer this question by building up a simple theoretical model and then analyzing a data set obtained from a sample survey of rural and urban families in West Bengal. It is found that job reservation reduces the incentive for spending on education by Schedule Castes.

Abhirup Sarkar and Kaushik Gangopadhyay

Crop Diversification by Poor Peasants and Role of Infrastructure

The question of sustainable income and employment in the rural areas seems to be very much dependent on the degree of diversification of land use towards cultivating various crops. In view of this,

crop diversification has been an important issue of agricultural development not only in India, but also in other parts of the world. In India, the growth of area under cultivation in different states remained stagnant in the current decades and the growth of yield of various crops has reached the saturation level. Efforts are now being made in different regions of India to cultivate those crops, which are remunerative and environment friendly. To examine this, an attempt has been made to study intensively, the nature and extent of crop diversification in West Bengal, a rice-growing state of India, for the period of 1970 to 2005. A number of explanatory factors have been considered to explain this phenomenon. Our findings, primarily based on official data, suggest that marginal and small farmers play a positive role in crop diversification and that has been supported by the growth of various infrastructure networks during the period under consideration.

Manabendu Chattopadhyay and Utpal Kumar De

Skilled-Unskilled Wage Inequality: A General Equilibrium Analysis

A static three sector competitive general equilibrium model of a small open economy, in which skilled labor is mobile between a traded good sector and a non-traded good sector and unskilled labour is specific to another traded good sector, is developed. Capital is perfectly mobile among all these three sectors. The effects of change in different factor endowments and of globalization on skilled-unskilled wage inequality are examined. It is found that the effect of a change of a factor endowment on wage inequality depends on the factor intensity ranking between two skilled labors using sectors and on the relative strength of the marginal effects on demand for and supply of non-tradable good. It is also fouind that a decrease in the price of product produced by skilled (unskilled) labor using traded good sector lowers (raises) the skilled-unskilled wage inequality.

Manash Ranjan Gupta and Priya Brata Dutta

Skilled-Unskilled Wage Inequality, Nontraded Good and Endogenous Supply of Skilled Labour: A Theoretical Analysis

A static four sector competitive general equilibrium model of a small open economy, in which skilled labour is endogenously produced by the education sector and is mobile between a traded good sector and a non-traded good sector, is developed. Capital is also perfectly mobile among the education sector, skilled labour using traded good sector and the non-traded good sector. However, land and unskilled labour are specific to another traded good sector. The effects of change in different factor endowments and reduction in tariff rate on skilled-unskilled wage inequality are analyzed. It is found that the effect of a change in different parameters on wage inequality depends on the factor intensity ranking between two skilled labour using sectors and on the relative strength of the marginal effects on demand for and supply of non-traded final good. The effects of changes in different parameters on the supply of skilled labour are also analyzed.

Manash Ranjan Gupta and Priya Brata Dutta

Public Expenditure, Environment, and Economic Growth

A model of endogenous growth with special consideration to the role of productive public expenditure in the presence of congestion effect of private capital and environmental pollution is developed. The properties of the optimal fiscal policy in the steady-state equilibrium, when the level of production of the final good is the source of emission, are analyzed. Government allocates its income tax revenue between pollution abatement expenditure and productive public expenditure. In the steady-state equilibrium, optimum ratio of productive public expenditure to national income is less than the competitive output share of the public input; and this ratio varies inversely with the magnitude of the emission-output coefficient. The steady-state equilibrium appears to be a saddle point; and the market economy growth rate is not necessarily less than the socially efficient growth rate in the steady-state equilibrium.

Manash Ranjan Gupta and Trishita Ray Barman

Skilled-Unskilled Wage Inequality and Imitation in a Product Variety Model: A Theoretical Analysis

A dynamic three-sector product variety model to analyze the role of imitation on skilled-unskilled wage inequality is developed. One of these sectors produces varieties of innovated products with skilled labour as well as unskilled labour and another sector produces varieties of imitated products with only unskilled labour. Also, there is a R&D sector developing blue-prints of new products with skilled labour as the only input. However, imitation is costless. It is shown that an increase in skilled (unskilled) labour endowment raises (lowers) the rate of growth, raises (lowers) the skilled-unskilled wage ratio, and lowers (raises) the level of social welfare. However, an increase in the rate of imitation raises this growth rate, lowers the skilled-unskilled wage ratio, and raises the level of social welfare.

Manash Ranjan Gupta and Priya Brata Dutta

Coincident Test and Convergence Hypothesis: Theory and Evidence

This paper develops tests for intercept homogeneity in stationary dynamic panel framework. It is then argued that these tests can be used as a test for absolute convergence assuming that conditional convergence holds. The proposed tests are shown to follow standard known distributions and also robust to cross sectional dependence. A detailed Monte Carlo study is then carried out to evaluate the performance of these tests in terms of size and power. The panel unit root tests, which are robust to cross sectional dependence, are applied to examine the conditional convergence hypothesis for per capita level income and also for per capita growth rates. Findings are stunning in nature. There is no convergence across any group of countries including the EU and the OECD in terms of real per capita income. However, conditional convergence is observed among the members of both EU and OECD in terms of growth rates. Finally, absolute convergence in growth rates is evidenced only for the EU group.

Samarjit Das, Ajay Pal and Manisha Chakrabarty

Intercept Poolability Test under Cross-sectional Dependence

This paper develops a test for intercept homogeneity in fixed-effects one-way error component models assuming slope homogeneity. The test is shown to be robust to cross sectional dependence; for both weak and *strong* dependence. We show that the proposed test may be used as a test for random effect model *vs.* fixed effect model. The proposed test is shown to have a standard limiting distribution and is free from nuisance parameters. Monte Carlo simulations also show that the proposed test delivers more accurate finite sample sizes than existing tests for various combinations of *N* and *T*. Simulation study shows that *F*-test is either over-sized or under-sized depending on the pattern of cross sectional dependence. The performance of Hausman test (1978), on the other hand, is quite unstable across various *DGP*s; and empirical size varies from 0 % to the nominal sizes depending on the structure of error variance-covariance matrix. The power of the proposed test outperforms the other two tests.

Samarjit Das and Gopal K. Basak

Economic Growth and Income Inequality: Examining the Links in Indian Economy

In this study, the Kuznets' inverted U-hypothesis for economic growth is tested on balanced panel data set relating to fourteen Indian major states for the period 1958 to 2005 using two-way fixed effects model. Different competing model specifications have been studied and the best one fitting the data is selected. It is found that Kuznet's hypothesis holds for Indian States during the period under study

Samarjit Das and Gouranga Sinha

On Technology Licensing in a Hotelling Structure

This study analyses the question of optimal licensing contracts in a Hotelling structure. It is shown that a royalty equilibrium exists if and only if transport cost lies in a specified interval, but the royalty rate

can be higher than the amount of cost saving. While fee licensing only is never profitable, the optimal licensing contract consists of a fee plus royalty. In equilibrium the market is fully covered with monopolistic goods.

Tarun Kabiraj and Ching Chyi Lee

Spatial Econometrics

A source of spatial variation in estimates of poverty is the geographically segregated units characterized by their intrinsic nature of development status (level of living). It is known that there is considerable difference in the levels of economic well being in two parts of Bengal, viz., North and South Bengal, a traditional division of West Bengal with respect to the River Hooghly. Given this, an attempt has been made to identify the sources and characteristics affecting the differential levels of economic well being (poverty) in the two parts through introduction of spatial autoregressive dependence in the monthly consumption expenditure values within North and South Bengal.

Amita Majumder, Somnath Chattopadhyay and Hasanur Jaman

Earnings Frontier

'Potential earning', a concept derived from human capital theory, can be interpreted as 'income frontier'. Given endowments (resources), the deviation of actual earning from the frontier gives a measure of 'deficiency in utilization of resources' (inefficiency). Household level earning frontier functions have been estimated for two eastern states of rural India, namely, West Bengal and Orissa using the nonparametric Data Envelopment Analysis (DEA) method and the relationships among level of living, occupational status and efficiency obtained from the DEA analysis are examined. The influence of social opportunities on frontier income is also examined and the results are interpreted in terms of policy implications.

Amita Majumder, Chiranjib Neogi and Manisha Chakrabarty

Vulnerability

Vulnerability to poverty is defined as the magnitude of the threat of poverty or security risk. An axiomatic characterization of the Chakravarty vulnerability index is developed using a von Neumann-Morgenstern utility function. A numerical illustration of the index is also provided using most recent data on rural West Bengal. On an overall basis, while the least poor districts remain least vulnerable, the poorest districts are most vulnerable. The empirical exercise also reveals that some districts, that are most vulnerable in terms of mean values of vulnerability, are also the major contributors to the level of vulnerability of rural West Bengal. The most vulnerable districts are mainly border districts with other states of India and/or Bangladesh. These results can serve as important inputs to the policy planner.

Satya R. Chakravarty and Amita Majumder

Inequality

Income inequality in India is decomposed using subgroup/ additively decomposable inequality indices that satisfy a general notion of inequality invariance, known as the intermediate inequality equivalence condition, which contains the relative and absolute concepts as particular cases. Relative and absolute concepts of inequality demand inequality invariance respectively under equiproportionate and equal absolute variations in all incomes. The intermediate condition is a convex mix of the relative and absolute views. The subgroups considered here are the states of India. It turns out that the urban sector is more unequal than the rural sector and in each sector the contribution of 'within-group' component is dominant over its 'between-group' counterpart. The nature of dominance is more prominent in the urban sector.

Satya R. Chakravarty and Amita Majumder

Inter-country Variations in Achieving the Millennium Development Goals

The Millennium Development Goals (MDGs) are drawn from the actions and targets contained in the Millennium Declaration, adopted by 189 nations at the UN Millennium Summit held in September

2000. These goals respond to the World's main development challenges. The MDGs are: Eradicate extreme poverty and hunger; Achieve universal primary education; Promote gender equality and empower women; Reduce child mortality; Improve maternal health; Combat HIV/AIDs, malaria and other diseases; Ensure environmental sustainability and Develop a Global partnership for Development. The target year set for most of the goals was 2015. These eight MDGs are broken down into 21 quantifiable targets that are measured by 60 indicators. Since the adoption of these goals, considerable attention has been paid by different researchers and research organizations to study whether the countries would achieve these goals within the stipulated date. Broadly, it has been observed that as a whole the developing world is "off track" with respect to the most targets. It has also been observed that the countries differ a lot towards meeting the targets - there are significant inter-regional as well as intra-regional variations in achieving the targets - some regions/countries have progressed well enough in some indicators and lagging in respect of some other indicators. In this context, it is worthy to explore the determining factors behind variations in achieving the targets. The study divides the developing world into six broad regions: (i) Sub-Saharan Africa, (ii) Middle East and North Africa, (iii) East Asia and Pacific, (iv) South Asia, (v) Latin America and Caribbean and (vi) Eastern Europe and CIS.

Krishna Mazumdar

Life Expectancy at Birth: Proposed Measure for Human Well-being

Human well being is the center of all human activities. Associated with this is the issue of measurement of human well being. This study measures human well-being in terms of achievement in life expectancy at birth. The reason behind this is that people are expected to be most happy with added years of life - each and every people in each and every society in all time all over the world aspires for longer life. In fact, increase in life expectancy is an important manifestation of improvement in human well-being. Moreover, life expectancy is associated with many other indicators representing human well-being. Therefore, it is worthy to obtain the major factors that determine the life expectancy of the people of a country. In this context, the study formulates a simultaneous-equations model. Data for 2005 are used to estimate the model. Finally, relevant policies for improvement in life expectancies have been suggested.

Krishna Mazumdar

Life Expectancy at Birth Half Century: Changes, Causes and Consequences

Each person in every society at all times all over the world aspires for longer life. In fact, increase in life expectancy is an important manifestation of improvement in human well being. Over the last fifty-sixty years life expectancy at birth has increased beyond expectation in most of the countries. This is a major achievement of mankind in the last century. The study attempts to find absolute and relative changes in life expectancy over the last half century (1960 to 2010) for the countries, for which time-series data are available. In this respect regional variations have been taken into account. It has been observed that there exist stark differences among countries in the level and rate of achievements in life expectancy. It has also been found that there are inter-regional variations. This study further tries to find the causes behind the levels and rates of achievements of different countries as well as different regions. Increased life expectancy has some good and bad consequences.

Krishna Mazumdar

Efficient Access Pricing and Endogenous Market Structure

How regulatory mechanisms influence the nature of competition in a network industry is investigated. In the downstream segment of the market, the seller of a differentiated retail product competes with an incumbent firm. The incumbent firm is also the owner of the essential input. The regulator cannot observe the costs of the entrant, and to maximize social welfare designs the retail prices and the access charge that the entrant pays to the incumbent. The optimal access charge is a uniform price that respects the criteria of transparency and non-discrimination that are imposed by the competition and regulation directives in most of the countries. New formulas for retail and access prices adhering

to the Ramsey rule are derived. Since the competing firm takes the decision to enter following the choice of the regulatory regime, the nature of the retail market competition is endogenous. It can either be served by both the firms, or can have the incumbent as the monopoly supplier of the retail good.

Manipushpak Mitra, Kaniska Dam and Axel Gautier

On that Old Rivalry: Bertrand versus Cournot

The classic comparison between Bertrand and Cournot outcomes in a symmetric differentiated oligopoly where each firm maximizes a weighted average of its own profit and welfare is considered in the study. For general utility functions, the standard Bertrand-Cournot rankings are reversed for all variables---prices, quantities, profits, consumer surplus, and welfare---provided the weight on profit is strictly less than a threshold value. Surprisingly, it is found that the threshold can be arbitrarily close to unity for two widely used utility specifications, quadratic and CES. The threshold weight increases as the degree of substitutability declines. In addition, for CES, the threshold (i) increases as the number of firms increases and (ii) irrespective of the degree of substitutability, tends to unity as the number of firms approaches infinity.

Manipushpak Mitra and Arghya Ghosh

Privatization in Open Economies

A differentiated oligopoly market is considered where a domestic public firm competes with foreign firm(s). Under fairly general demand and constant marginal costs, it is shown that partial privatization of the public firm improves welfare by cutting down public sector losses. Surprisingly, even at the optimal level of privatization the public firm's price lies strictly below marginal cost and it makes losses. In the long run, with free entry of foreign firms, partial privatization improves welfare through an additional channel: more foreign varieties. However, in the long run, under optimal privatization, below-cost pricing does not occur and the public firm earns positive profits.

Manipushpak Mitra, Arghya Ghosh and Bibhas Saha

Incentives in Symmetrically Excludable Public Goods Problems

The symmetric class of public goods problems with exclusion possibilities, where first best is achievable, is characterized. First best means that efficient public decisions can be attained by means of balanced transfers. It is shown that FB implementability is possible if and only if “full excludability” is permitted, that is the public good acquires the characteristic of a private good.

Manipushpak Mitra and Arunava Sen

No Envy, Egalitarian Equivalence and Strategyproofness in Queueing Problems

Mechanisms satisfying strategyproofness, efficiency of decision, and either one of two equity notions, no-envy and egalitarian equivalence are studied. Both equity notions are compatible with strategyproofness and efficiency of decision but they give rise to different subsets of VCG mechanisms. Furthermore, while no-envy is compatible with budget balancedness or weak group strategyproofness, egalitarian equivalence is not compatible with either.

Manipushpak Mitra, Youngsub Chun and Suresh Mutuswami

Bidding Rings: A Bargaining Approach

The problem of coalition formation in single as well as multiple indivisible goods second price auction with unit demand is analyzed in a bargaining game set up under the assumption of complete information. Here valuation of the participants is commonly known amongst themselves, while the auctioneer is unaware of these valuations. In the single goods case, the necessary and sufficient conditions for formation of any bidding ring when players are sufficiently patient are identified. In the multiple goods case, the sufficient conditions for formation of an interesting class of coalition structures

are also specified. In the multiple goods case where exactly one winner colludes with all the losers and, depending on the protocol, the remaining winners either stay alone or collude in pairs.

Manipushpak Mitra, Kalyan Chatterjee and Conan Mukherjee

Bipartite Graphs and the Shapley Value

A cooperative game-theoretic structure to analyze bipartite graphs is provided where there is a set of employers and a set of workers. Links can form between an employer and a worker and there is no link either between employers or between workers. As in Myerson (1977), a cooperation structure is represented by a set of bilateral links. However, unlike Myerson (1977), bilateral links can only be formed between some employers and some workers. In this scenario the Shapley Value is characterized.

Manipushpak Mitra and Dipjyoti Majumdar

Clinical and Bacteriological Correlates of Whole Blood Interferon Gamma (*IFN-γ*) in Newly Detected Cases of Pulmonary TB

The present study had been undertaken to determine if the capacity to produce interferon gamma (*IFN-γ*) in whole blood is related to bacteriological, hematological, radiographic and clinical presentations in new, HIV seronegative cases of pulmonary tuberculosis. 80 cases and 50 control subjects aged 15 years onwards, representative of Kasturba Hospital and Nursing schools of Wardha district of Maharashtra state in India were examined for their health condition with standard methodology. Amongst the TB patients, 73.8% were QFT positive (*IFN-γ* concentration 0.35 IU or more) as against none in healthy controls. The mean *IFN-γ* concentrations varied between 9.5840 IU (50-59 years) and 2.5838 IU (60 + years), showing no trend. The differences in positivity or mean *IFN-γ* concentrations were statistically insignificant. Both the QFT positivity and *IFN-γ* concentrations were found to be higher in normal lymphocyte per cent as compared to below and above normal, but differences were not statistically significant. Conclusion: The *IFN-γ* concentrations did not correlate with any of the predictors of disease severity studied, the levels were found to be significantly higher in diseased as compared to healthy subjects.

Manoranjan Pal, M. Bandyopadhyay, A. Bhakta, S. Chakrabarty and P, Bharati

Socio-Economic Determinants of Underweight Children in West Bengal, India: A District-Wise Analysis

In order to understand undernutrition at district level along with socio-economic influence, an attempt has been made here to study the socio-economic determinants and the district-wise prevalence of underweight children of age 0-71 months in West Bengal. The data have been accessed from the Reproductive and Child Health Survey (RCHS-II) conducted in 2002-03, which contain information on 7550 children and their parents. Information on socio-economic variables of the associated families of these children has also been taken for our study. This study computes weight- for- age z- scores to assess the nutritional status of the children using WHO (2006) reference. The prevalence of underweight is seen to vary over the districts. Districts with very high prevalence of underweight children are Murshidabad, Burdwan, Purulia, Medinipur, Howrah and South 24 Parganas. High prevalent districts for both the boys and girls are Jalpaiguri and Coochbihar. Low prevalent districts for both boys and girls are South Dinajpur, Nadia and Kolkata. The percentage of underweight children are found to be more in rural areas, among Muslim families, with illiterate parents and belonging to families with low standard of living. In Murshidabad, Bankura, Nadia, Medinipur and South 24 Parganas districts, i.e., where prevalence of underweight children are more, the rural and urban differences are less. The characteristics like religion, parent's educational status and standard of living index show a significant effect on the children's weights. Public intervention programs on the parent's education and the standard of living of the households at district level should be given high priority to combat the children's undernutrition problems so far as weight for age is concerned.

Manoranjan Pal, Suparna Som, Suman Chakrabarty, Susmita Bharati and Premananda Bharati

Socioeconomic Impact on Child Immunisation in the Districts of West Bengal, India

Knowledge of inter-district variations in immunisation coverage and the reasons for their existence is of utmost importance in a region in which variations in the socioeconomic factors are known to have a marked influence on immunisation coverage. This study was based on a sample of 1,279 children aged 12–35 months. Data was obtained from the District Level Household Survey under the Reproductive and Child Health project (DLHS-RCH-2) that was conducted from 2002 to 2004. Descriptive studies and logistic regression analyses were conducted to examine the variations in immunisation coverage. Approximately 54 percent of children in West Bengal were covered for immunisation. The results for receiving full immunisation varied greatly between the various districts, ranging from 23.3 per cent in Murshidabad to 72.2 per cent in Hugli. Low rates of coverage were found among the vulnerable groups of poor minorities, especially in rural areas. No evidence of gender differences was found. The educational level of the parents was found to have a significant influence on child immunisation coverage.

Manoranjan Pal, Suparna Som, Suman Chakrabarty and Premananda Bharati

Influence of Ethnicity, Geography and Climate on the Variation of Stature among Indian Populations

This study analyzes the variation in the mean stature of adult males of a variety of population groups in India and examines the influence of geographical, climatic and ethnic factors on it. A considerable variation in mean stature has been found with respect to these three attributes. Variation 'between' ethnic groups compared with 'within' ethnic groups was found to be much more than that of geographical and climatic zones. Scheduled Castes (SC) and Scheduled Tribes (ST) populations have much low average height than that of General Castes (GC). Climatically dry and semiarid zones have a tendency to have higher stature than in the Monsoon areas. The mean height has been found to be the highest in north India. It is closely followed by west India. An interesting feature is that as one goes towards east and south the mean height gradually decreases. It is the lowest in islands. The mean heights have been regressed on geographical, climatic and ethnic factors, after converting these factors into binary variables. The regression analysis has strengthened the findings, that there is a highly significant relationship between height and geographical, climatic and ethnic factors.

Susmita Bharati, Dipak Mukherji, Manoranjan Pal, Suparna Som, Dipak Kumar Adak, T.S. Vasulu and Premananda Bharati

Height and Weight of Pre-school Children: A Comparison between Two National Family Health Surveys in India

This study attempts to make a comparison of height and weight of pre-school children of 1998-99 with that of 1992-93 using National Family Health Survey (NFHS) data along with the investigation of underlying causes. The sample sizes are 22,055 and 26,432 respectively for the two surveys, i.e., NFHS-1 (1992-93) and NFHS-2 (1998-99). Besides height and weight data on socio-economic and other family background like age-groups and education of mother, birth order, caste and religion etc. are also taken to see the difference of effect of these variables on height and weight between the two time periods. Though there has been a substantial difference between boys and girls, the changes between the two periods are not much for height but weight has increased to some extent for both boys and girls. The increase in weight for boys is more than that of girls. Rural-urban differences are conspicuous, urban children being better with respect to both height and weight. Variations of these performances have been observed over zones, age-groups, mother's education and religion and castes. Regression analysis also supports this view. Age, mother's education and religion and caste play important role in determining the growth of children. The effect of zone-wise variation is possibly due to other variables not taken into account in this study.

Manoranjan Pal, Susmita Bharati and Premananda Bharati

Do Socioeconomic Development and Improvement of Health go together? - A Comparison among Indian States

Socio-economic development in a country is very much linked with the improvement of overall status of health of the people in the country. The causality works both ways. However, the degree of relations between the two varies over region and time. This paper is an attempt to show how health status is linked with the socio-economic status in different states of India. The health status is seen only for children and women and the data are taken from National Family Health Surveys (NFHS-2 and NFHS -3). For other development parameters National Sample Survey (NSS) data are used. The socio-economic variables taken for this purpose are head count ratio, real mean consumption, sex ratio, literacy level and infant mortality rate whereas the health variables are mainly the morbidity parameters like acute respiratory infection, diarrhea, anemia, low nutritional status etc. The results show that a decrease in the incident of disease is directly associated with an increase in the socio-economic development, at least in the southern states. In addition to calculating the correlations between pair-wise variables, we have found the rank correlation between the average of ranks of socio-economic variables and of health variables. We have also found the canonical correlations between the two sets of variables. The two correlations agreed very well. This was done separately for rural and urban sectors.

Suparna Som, Manoranjan Pal and Premananda Bharati

Estimation of Non Sampling Variance Components under the Linear Model Approach

A survey may be used in a wide sense including complete enumeration as a special case. A complete enumeration has no sampling error at all; but for that, one should not jump into the conclusion that a complete enumeration leads to error free results. In fact, the associated non-sampling or measurement errors may be considerable and even more severe than those in sample surveys. The importance of non-sampling or measurement errors has long been recognized. Attempts have been made for estimating components due to non-sampling errors. The work in this area starts developing surveys especially designed to incorporate features which can facilitate the estimation of non-sampling errors. However, most of the survey designs so far developed, though few, are very complex in nature. Here a very simple survey design as well as a simple estimation procedure have been developed for the purpose of estimating simple as well as correlated response variances, namely interviewer variance and supervisor variance.

Pulakesh Maiti

The Child Labour and Child Work: An Assessment of Harm for Indian Children

Both child labour and child work are considered as serious problems in the arena of social justice as in both cases these engagements lead to the denial of normal childhood. Under normal circumstances a child is expected to gain some training through proper schooling along with some hand-on practical experiences. This would help him/her to earn more in future and manage life more efficiently through conscious decision making. So, early entry in labour market implies a compromise with the extent of human-capital formation and a corresponding loss in future earning. On the other hand excessive engagement in domestic chore may also have its adverse implications on proper physical and mental development of the child. The current literature concentrates excessively on the child labour problem and this dormant issue of child work is rather under-attended so far, while both might have been creating a wide gap between achievements and capabilities of these children. An attempt has been done to understand child work as what should actually constitutes child labour and which kind of work is child friendly from the perspective of potential harm hence caused to the children. So measurement of deprivation for both child labour and child work in terms of denial of normal childhood experiences is the focal issue being addressed in the study. The data-base utilized for the analysis has been extracted from the survey data of 61st (2004-2005) round on ‘Employment and Unemployment Situation in India’, conducted by the National Sample Survey Organization of Government of India. The study is a new attempt. It indicates that extent of deprivation to the society from child work is much

higher than that for child labour alone and this difference bears serious gender implication. Finally, the effects of different socio-cultural variables vary widely across regions.

Saswati Das

Women Empowerment in India

The present study is based on the conception that to what extent women is empowered in Indian society to make their own choices and can transform those choices into desired action. In this context this study attempts to measure the level of women empowerment achieved in India and identify the determining factors behind such empowerment.

Chaiti Sharma Biswas

Financial Econometrics

The world-wide economic crisis in 2007, apparently triggered by escalating housing prices in the USA, is currently a subject of intensive empirical research. All these studies are primarily aimed at providing explanations – from consideration of both economics and finance – as to why the crisis occurred and what are the important factors behind this crisis. A joint research work is being done with Prof. Mahua Barari Mitra of Missouri State University, USA, to look into this important issue from consideration of structural break and volatility of all the relevant series and the dynamical effects of the variables as captured through vector error correction model and cointegration. To this end, the univariate time series analysis of the US house price index, long term interest rate, mortgage rate and other relevant variables is now being carried out. Both the in-sample and out-of-sample forecasts are also being obtained by different modelling approaches. Empirical determination and forecastability of major economic and financial variables like foreign exchange rate, stock market index and inflation are being carried out by applying modern techniques of time series econometrics. In this, due consideration is being given to important data characteristics like volatility and multiple structural breaks.

Nityananda Sarkar and Mahua Barai Mitra

The models considered are SETAR, SETAR-GARCH, Double Threshold GARCH, Smooth Transition Autoregressive and the Markov Switching Regression models.

The empirical exercises done on the topics would throw some light on the nature of volatility in the financial variables concerned, and also the extent to which these nonlinear models are able to capture volatility, persistence and regime shifts inherent in the financial variables of an emerging/developing country like India. Works are also being done on modeling India's inflation as well as the uncertainty in inflation. In this, different filters are being used along with consideration to breaks to estimate output gap etc. The usefulness of different hybrid models on inflation is being studied in the Indian context. Research is also being done to find some kind of a unified approach in modeling and forecasting inflation.

Nityananda Sarkar

Impact of Economic Reforms on Tribal Poverty

Rural development and poverty alleviation efforts have long been a policy priority in India. But they have gained new impetus as a result of India's renewed economic vigor and political development in recent years. The present study is planned to focus the poorest of the poor section i.e. the Adivasis or the tribes. Precisely the objectives are: To identify the available natural resources and the extent of their degradation To assess Tribes' stake and involvement over local resources.To identify the socio-economic condition of the tribes in the context of various policy measures taken during post-reform period. To find out the development indicators of the tribes and formulate a Tribal Poverty Index. Over 119 villages of 19 blocks in five districts of three eastern states have been covered as study area. The districts are: Purulia and jalpaiguri of West Bengal; Koraput of Orissa and Dumka and Jamtara of

Jharkhand. Altogether 1000 households have been covered. The data are being analysed and draft report is expected to be submitted in May this year.

Kunal Chattopadhyay and Chiranjib Neogi

Development of Methodology towards Measurement of Poverty

In view of the fact that the norm of 2400 Kcal for rural India and 2100 Kcal for urban India for calculation of poverty line were prescribed sometime in the beginning of seventies, MoS&PI desired to know whether these norms still hold good as of now as the consumption pattern as well as the quantum of daily energy requirement might have undergone changes during the last 35 years. Some of the findings and recommendations of the project are: Using the calorie norms supplied by the Task Force, Expert Group, ICMR and FAO it turns out that the calorie poverty rates by direct method are always higher than the fixed calorie line method. Urban poverty is found to be more than corresponding rural poverty when activity levels of adults are not considered. Calorie poverty rates show an increasing trend whichever method is used except for urban sector during 50^{th} and 55^{th} rounds of NSS. Two entirely new methods have been proposed in this report – Calorie Decomposition Method and the Error Distribution Method. Poverty Rates found by both the methods are higher than expected. Some modifications of the error decomposition method have also been proposed. The NCO-1968 codes have been regrouped according to the activity status and calculated the poverty rates by direct method. It improved the estimates to some extent. Most of the south Indian states show very high values of the poverty rates. Also these values are relatively higher than those states known to be the poorest states in India. For example Bihar has the rural poverty rate as 0.55, whereas the states like Karnataka and Tamilnadu have poverty rates higher than 0.80.

Socio-Economic Conditions of Five Minority Communities in the District of Murshidabad, West Bengal

Designing of the schedule and specification of the format in which data have to be collected has been over. A number of field visits have already been made to train the locally recruited investigators for data collection. The training is over and following the above sampling design, field work is in progress. The data have been collected, processed and now the work is at the stage of data analysis.

Pulakesh Maiti

Economic Analysis Unit, Bangalore

The Economic Analysis Unit (EAU) is engaged in research in quantitative methods in economics and social sciences. Application of these methods to different problems in agriculture, industry and monetary economics is actively pursued. Topics for the current research include developing economy-wide models using VAR and VEC methodologies and simulations; and also analysis of the importance of institutions for economic growth and globalization.

Linguistic Research Unit

During the period (from April 2010 to March 2011) the *Linguistic Research Unit* of the Institute has been continuing with its programs of research in the areas of *Cognitive Linguistics, Language Technology, Clinical Linguistics* along with some path-breaking works in the area of mainstream linguistics.

Cognitive Linguistics

The unit has initiated the substantivist study of conceptual networks on the basis of *Whole Word Morphology*. Earlier work has demonstrated a connection between this inquiry and the linguistics of

lexicophrasal difficulty. The unit has now initiated intensive research in conceptualization kernel studies.

Probal Dasgupta

Corpus Linguistics and Language Technology

The unit is engaged in developing a corpus-based digital lexicon for Bengali language along with a strategy for Computational Lexicography in Bengali and other Indian languages. At present it is working on a model for Corpus Based English Language Teaching (C-BELT); developing domain-specific parallel corpora between Hindi and Bengali; developing a WordNet for Bengali in parallel with Hindi and English WordNet; and developing rules, principles and methods for POS tagging of Bengali text corpora. So far it has developed and proposed a model known as SHELL System for teaching English to Indian learners. It has successfully explored and proposed a large set of rules for the characters used in Bengali script for text-to-speech conversion, computational lexicography, language teaching, language cognition, and machine learning. It has designed a model for developing a Pronunciation Bengali Dictionary in digital and printed form, and working towards developing a dictionary for idiomatic expressions, phrases and collocation for machine learning. It is also working for generating a lexical database for basic and graded vocabulary to be used in C-BELT system.

Niladri Sekhar Dash

Clinical Linguistics

A number of linguistic and cognitive tests are already conducted on children with neurolinguistic disorders and language impairment (L1) to raise a need for appropriate methodology and up-graded assessment tools. The *homogenized therapeutic approach* is one such methodology that has been adopted in upgraded database, generated from detailed analysis of various Indian speech sounds.

Shubhasree Ganguly

Sociolinguistics

The unit has taken up studies in linguistic (lexical and syntactic) difficulties. The sociolinguistic dimension of linguistic difficulty has been studied within single languages, in relation to the mapping between the full conceptualization system and its basic level kernel, and across languages in the Indian context. Here the important target of study has been the place of English in the sociolinguistic fabric of India.

Probal Dasgupta

Planning Unit, Delhi

The Planning Unit faculty has, as in the past, continued to work on the cutting edge of economics research, both in theory, as well as empirical analysis. Moreover, much of the research conducted by the unit has relevance for India in particular, and LDCs in general. Bargaining theory has been used to analyze multi-person bargaining with potential applications to the land acquisition problem, an issue of obvious topical interest to India. Theory has also been harnessed to analyze the appropriate role of NGO intervention in micro-finance, with possible direct implications for the SHG-linkage approach to micro-finance being followed in India. Other issues of theoretical interest analyzed by the faculty include, cost allocation in minimum cost arborescence problem, cooperative games with limited communication and multidimensional mechanism design for public goods. Issues like trade policy and polarization in labour markets, diversity and break-ups have also been investigated. Issues affecting the Indian growth performance, as well as the bio-technology and cotton input market in India has also attracted attention. Social capital and collective action in the Himalayas, payments for ecosystem services in Kerala/Tamil Nadu, agricultural fires and air pollution in India have also attracted attention. Measurement of economic burden of households suffering from cancer, firm investment with imperfect capital markets, public investment, the effect of national rural guarantee scheme, are some of the other issues examined.

Here is a more detailed break-down of research interests:

Trade Policy and Labour Markets

In game theory, a major research area has been the design of incentive-compatible mechanisms in a variety of settings. These include characterizations of efficient, incentive-compatible rules in exchange economies and a deeper understanding of probabilistic mechanism design. Work has also focused on environments where transfers are possible (quasi-linear models) as well as voting environments where agents attempt to aggregate partitions. In macroeconomics, the literature on growth and distribution is being extended to an open economy framework. Also on the research agenda is the issue of talent allocation and economic growth, and the impact of trade liberalization on product quality. In financial development, dynamic aspects of micro-finance have received attention. Schemes have been proposed (potentially applicable to India) that can solve the informational problems intrinsic in micro-finance.Empirical analyses of the Indian economy have encompassed a wide range of issues. In environmental economics, a study of groundwater sales found high prices averaging 60 paise per cubic meter and a one-for-one responsiveness of water use to price suggesting that marginal cost pricing of electricity would substantially diminish groundwater over-extraction. Research in commodity markets showed that open economy policies and imports were critical in facilitating the evolution of a futures market in soya oil. A policy study on energy subsidies concluded that while the case for abolishing LPG subsidies was strong, eliminating kerosene subsidies would cause large welfare losses unless it is accompanied by rural electrification. Other current research projects include examination of non-linear relationship between child labour and land wealth of households, benefits of road connectivity in rural India, measures of multidimensional inequality, and the costs of plant biotechnology regulation.

Satya P. Das, Chetan Ghate, Abhiroop Mukhopadhyay, Bharat Ramaswami, Tridip Ray, Probal Ray Chowdhury, Debasis Mishra, Arunava Sen and E. Somanathan.

Experimental Evaluation of Multi-Object Auctions, Multidimensional Mechanism Design.

Debasis Mishra

Long-term Impact of Displacement on income and other components of well-being, bridging the Shencottah Gap: Using Payments from Ecosystem Services for Biodiversity Conservation, Impact of Agricultural Residue Burning on Air Pollution in South Asia, Climate Policy in the Absence of Commitment, Testing for Social Capital.

E. Somanathan

Developing a theoretical model to understand secondary education and its effect on economic growth in India; Theoretical models for understanding sectoral policies and structural transformation in India; Fiscal policy and endogenous specific technological change; Understanding business cycle fluctuations in India using a New Keynesian DSGE framework.

Chetan Ghate

Finding a Tracking Identifier for Poverty.

Abhiroop Mukhopadhyay

Theoretical modeling of Micro-finance and credit; Bargaining between multiple sellers and single-buyers and theoretical issues related to land acquisition.

Prabal Roy Chowdhury

Growth of the Service Sector in India; Theoretical measures of Inflation Persistence Trade Policy, and Labour Market Polarization.

Satya P. Das

Nash implementation with Behavioral Players; Incentive-Compatible with random mechanisms.

Arunava Sen

Inequality, Neighbourhoods and Welfare of the Poor, Regional Inequality, Location Choice and Quality Ladder; Uncertainty, Arbitrage and Industry Location.

Tridip Ray

Population Studies Unit

Faculty members and Research Associates of the Population Studies Unit have participated in teaching Demography to the ISEC Trainees both in the main and the specialization programme. Individual- specific research areas are listed below:

Temporal and Cross-sectional Analysis of Population Ageing in India and Finding Associated Socio-economic and Health factors

Four Rounds of National Sample Survey findings on population ageing have been analyzed thoroughly applying appropriate statistical tools and techniques to investigate the nature of population ageing in India, its spatial and temporal variation and the effects of various socio-economic and health factors. Findings emphasize the urgent necessity of formulating appropriate policy for ensuring a state of well being of the aged population with special focus on the woman aged population.

Sanjeev Bakshi and Prasanta Pathak

Special Form of Gompertz Model and Its Application

A special form of Gompertz model in which all parameters have direct demographic interpretation has been proposed in this study. Relative merits and demerits of the proposed model, in comparison to the other popular forms and the transformed versions of the Gompertz model, have been discussed. The proposed model has been fitted to the cohort fertility schedules of high fertility countries like India and low fertility countries such as the USA, Austria, Slovakia, etc. In the context of India, the proposed model has been compared with other fertility models like Gamma model, Beta model, Hadwiger model, CT model, etc. It was found that the proposed model provides good fit to the cohort fertility schedules of high and low fertility countries.

Samba Siva Rao Pasupuleti and Prasanta Pathak

Spatial and Temporal Changes in Fertility Behavior of Indian Women Cohorts

This study investigates spatial and temporal changes in the fertility behaviour of cohorts of Indian women. Data from all three National Family Health Surveys have been used in this study. A six-parameter Gompertz model has been proposed and made use of for quantification of the fertility behaviour of the cohorts of Indian women. One of the several findings includes: drop expected in Cohort Total Fertility Rate (CTFR) was the highest in North-east India (from 5.80 to 3.08) and the lowest in Central India (from 6.34 to 4.76) among the cohorts of women who ended their reproductive period in 1993 and those who will end their reproductive period in 2025.

Samba Siva Rao Pasupuleti and Prasanta Pathak

Changes in the Dynamics of Tubal Sterilization Practice in India

Role of tubal sterilization is vital in India's fertility decline. In this study changes in the dynamics of tubal sterilization practice in India and its different regions, over cohorts have been investigated. Three models for age pattern of acceptance of tubal sterilizations in India have been proposed. These models have been compared with one another and the best fitted model so obtained has been used to study the dynamics of tubal sterilization practice across the regions of India. An index has been

introduced to quantify the amount of reproductive period averted due to tubal sterilizations and has been used for explaining regional variation in fertility level in the country.

Samba Siva Rao Pasupuleti, Asis Chatterjee and Prasanta Pathak

Cohort fertility patterns by socio-economic and cultural characteristics in India

Knowledge on fertility levels, trends and differentials in India have been accumulated mainly on the basis of cross-sectional fertility data. The existing knowledge on fertility behaviour of cohorts of Indian women born in various calendar years is rudimentary. Present study fills this knowledge gap by investigating cohort fertility patterns of Indian women by their socio-economic and cultural characteristics.

Samba Siva Rao Pasupuleti and Prasanta Pathak

Changing Pattern of Labour Absorption in Jobs during 1981 to 2001 by Age, Sex, Education and Residential Area in Different Districts of West Bengal

The study makes use of the census data and shows by applying appropriate statistical tools and techniques how labour absorption possibilities in various jobs vary over time in rural and urban areas of different districts in West Bengal by sex and level of education. The districts have accordingly been categorized for each census year in a consistent manner to show the areas that remained neglected or were irregularly taken care of in terms of creation of jobs.

Prasanta Pathak and Susanta Datta

Estimation of Technical Manpower Requirement in West Bengal through Effective Means for Improving Quality of Training of Technicians

In this study, funded by West Bengal State Council of Technical Education, Government of West Bengal, an attempt has been made to estimate trade wise the requirement of technical manpower with technical diploma and certificate level education in the coming ten years of industrially resurgent West Bengal. Passed out students and teachers of polytechnics and industrial training institutes have been interviewed and feedback from selected important industries have been taken into account to find out effective means for improving quality of training of technicians including introduction of new courses. The findings of the study have been shared with the stakeholders in two workshops to incorporate appropriately their feedback.

Prasanta Pathak

Child Mortality Estimation in India

Trends in child mortality in India for the cohorts of mothers in 1955 to 1991 which were obtained from three rounds of National Family Health Surveys (NFHS) in India have been studied. Conventional methods and probabilistic methods were adopted in obtaining under five mortality. These are compared with that obtained through Bayesian analysis of the NFHS data. It has been detected that the estimates are affected by truncation of the data for the beginning year and last year. Investigation using parametric versus nonparametric truncated distributions in estimating child mortalities is going on.

Reetabrata Bhattacharya and Arni S.R.S. Rao

Coverage Rates of Indian Census

Various methods of census coverage estimating methods for India and some other countries, viz, dual system methods, triple system methods etc. have been critically looked into. A simulation based analysis of the Indian Post enumeration Survey has been performed by developing a computational hierarchical model. Randomness in the house listing, household allocation within each house, and household sizes in each enumeration blocks has been introduced in our method. Investigation into the design effects in coverage rates is going on along with an attempt to develop methods for the same.

Kironmoy Chattopadhyay and Arni S.R.S. Rao

Research Activities

Nepali Immigrants in West Bengal: A Cluster Analysis

The objective of this study is to find out whether useful grouping or cluster exists among Nepali migrants in districts of West Bengal, a state in India. Agglomerative hierarchical single linkage clustering techniques have been applied to percentage of Nepali migrants by districts of West Bengal, using census 2001. Proximity matrix, agglomeration schedule and dendrogram have been prepared to identify different clusters. Dendrograms show relative size of proximity coefficients at which districts were combined. Districts with low distance/high similarity are close together e.g Dakshin Dinajpur, Bankura, Uttar Dinajpur, South 24 Parganas, Murshidabad, Purulia, Kooch Bihar, Birbhum, Maldah, Nadia, Medinipur etc. Darjiling and Jalpaiguri are merged at highest distance levels since they are dissimilar members in terms of larger volume Nepali migrants. Nepali migrants tend to cluster in the districts Jalpaiguri and Darjiling which are very adjacent to Nepal

Pranati Datta

Female Trafficking and Illegal Migration from Bangladesh to India

Trafficking is gross commercialisaton of innocent human life violating human rights and dignity. The accelerated pace of globalisation with free trade has left far reaching effect in South Asia and impact has been most on women and children who are most vulnerable. Specific gender related issues become evident when female migrants suffer human abuses because of their dual vulnerability as migrant as well as woman. It is very difficult to explain with reliable data that trafficking of women and children takes place along the path of illegal migration. This study is devoted to throw light on trafficking of women and children leading to illegal migration along Indo-Bangladesh border. It is observed that though documented female migration obtained from census reflects decreasing trend, undocumented i.e illegal migration due to trafficking is increasing along Indo-Bangladesh open border.

Pranati Datta

Analysis of Trends in Age Specific Mortality Rates

In this study, attempt is made to examine the trends in age specific mortality rates by sex and projection of mortality using the time series data from Sample Registration System (from 1970 to 2008. Objective of this study is to evaluate the trends of child mortality and age-specific mortality rate by sex and residence in India and major states. Attempt is also made to explore the differences of mortality rate among different age- groups and also differences of mortality rate among the major states in India.

Subhash Barman

Co-relates of Child Labour in India and States

Objective of this study is to examine the child labour rates under different socio-economic and demographic circumstances, differences of child labour force participation rates by sex, residence and castes. The study also examines the causes of child labour by sex and esidence using Census 2001 and National Family Health Survey (NFHS 3) Data. Child labour force participation rate is expected to be high among the Scheduled Castes and Scheduled Tribes caste groups. Their high participation in the labour force is closely associated with the poor educational level along with poor socio-economic status of these people.

Subhash Barman

Contraceptive Use and Intent in India

India is characterized by low contraceptive use rates and one of the highest fertility rates in the world. These rates are particularly higher for the poorest segment of the population. The objective of this study is to enhance the understanding of the modern contraceptive use in India through identification of the segments of Indian population at most need for contraceptive and family planning services. Using National Family Health Survey data, the study will highlight the impact of education, caste, place of residence and couple characteristics on contraceptive use and intent.

Subhash Barman

State wise Child Mortality and Its Cross Sectional Analysis

The study has been done by estimating parameters of extended Beta Binomial distribution using Newton Raphson method for iteration. Trend analysis of child mortality by using NFHS1, NFHS2 and NFHS3 data for different states in India has also been done.

Swati Sadhu

Economic Performance of the State of West Bengal during Last Four Decades

The main aims of this empirical study are to (a) investigate the economic transition of the state of West Bengal from mid-1960s to 2006-07 in terms of shares of primary, secondary and tertiary sectors in Net State Domestic Product relative to other major states of India, (b) find out the long run trends of per capita income of the states over last four decades with special emphasis of West Bengal, and (c) evaluate inter-state socio-economic performance in terms of 'district level achievements' as well as trace the best and worst performing districts of India in recent period.

Swagata Gupta

Measurement and Determinants of Infant and Child Mortality in India

Survival of children as it is known, highly influenced by social norms, cultural practices, the effectiveness of the maternal and child health programme and its reach to community by the programme efforts. In Indian context these factors are discussed in the study to understand the obstacles behind the progress of child health care interventions. Attempts have been made to find out the trends, differentials and determinants of persistently high neonatal and consequently other components of under-five mortalities in India for different regions and states using Sample Registration System (SRS) and three rounds of National Family Health Survey (NFHS) data. The result shows, infant and under-five mortality have declined substantially over the past 30 years. But the decline in urban areas has been slower than in rural areas, and as a result urban–rural mortality differentials have become smaller and the gap is more or less constant from 1998 onwards till date. Under-five mortality has declined due to reductions in the neonatal, post-neonatal and child mortality rates. But post-neonatal mortality has declined more rapidly than neonatal mortality during last two decades. It is important to reduce neonatal mortality in order to diminish overall under-five mortality in the country. During neonatal period, biological factors and maternal-child health care factors strongly affect the mortality. After that period, post neonatal and child mortality are attributed mainly to childhood diseases and accidents, which are governed by the social development and programmatic factors.

Partha De

Millennium Development Goals and Projection of Infant and Under-Five Mortality in India

India is a signatory of the Millennium Declaration of the UN Millennium Summit of 2000 and thereby committed to the achievement of Millennium Development Goals (MDGs) by the year 2015. The Millennium Development Goal 4 (MDG4) calls for a two-third reduction in under-five mortality rate (U5MR) from year 1990 to 2015. It aims at reducing under-five mortality rate from 125 deaths per thousand live births in 1988-92 to 41 in 2015. Now it is important to observe and analyse the present scenario to understand whether India would be able to achieve the targeted goals within the committed time described under the MDGs declaration. This study aims at forecasting the future possibilities of India achieving the MDG4 by 2015. Assuming that in the immediate future, the mortality will continue to follow the trend prevailing up to this point; projected values of IMR up to 2020 for the individual states and India are presented. A time series analysis for forecasting is carried out by applying Autoregressive Integrated Moving Averages (ARIMA) model to the IMR and U5MR. It appears that without further intervention, India would not be able to achieve the target of an U5MR less than 41 by 2015. Achievement of MDG4 will require further acceleration in the reduction of the U5MR, particularly

in the highest burden states like, Madhya Pradesh, Assam, Orissa, Uttar Pradesh, Rajasthan and Bihar.

Partha De

Impact of National Health Programme on Infant and Child Mortality in India

The main objective of this study is to examine the effect of health care programmes on infant and child mortality in India during three different time points of NFHS Studies (1992, 1998, and 2005). To find out the risk factors of child death in the country different maternal and health care variables are used after controlling the effects of other socio-economic and demographic variables. To determine this, Cox Proportional Hazard model has been utilized. It is found that infant mortality is lower among children whose mothers received three or more ANC check-ups as compared to those children born to mothers who either did not receive any ANC check-up or received less than three. The effect of ANC visits on survival during the post-neonatal period is more prominent than during the neonatal period. It is observed that if the mother is immunized with TT during pregnancy, the likelihood of both neonatal and post-neonatal death is reduced to half. Again, children born in institutions are likely to have a better health care assistance, and thereby have lower neonatal, post-neonatal and infant mortality rates.

Partha De

Psychological Research Unit

Emotional Display Rules and Personality Pattern Across Different Groups of Individuals

The objective of the study is to investigate the pattern of emotional display rules and its relationship with personality in visually impaired, hearing impaired and normal individuals. Data have been collected from these groups of individuals from five different regions of India. Findings of the study indicate that the patterns of emotional display vary from situation to situation and there is difference between the impaired groups with respect to their overall expression for emotion especially for anger and also for personality disposition. Significant associations between happiness and personality dimensions, for example, extraversion, agreeableness and conscientiousness were observed. Negative emotions like sadness and fear were found to be negatively related with extraversion and agreeableness.

Anjali Ghosh

Final (External) Evaluation of Special Adult Literacy Programme at Tripura

Final evaluation of special adult literacy programme on a sample of 3109 adult learners was conducted covering all the four districts of Tripura. The evaluation was conducted on reading, writing and numeracy. Results indicated that 88.7% of the learners in the whole state of Tripura qualified in evaluation and nearly 73% of the learners qualified in all the three subjects.

Anjali Ghosh and Himani Bhattacharya

Self-efficacy of agricultural farmers

This project aims at developing reliable and valid questionnaire to assess self-efficacy of agricultural farmers. One 50-items Likert type questionnaire was constructed and Cronbach's alpha coefficient for each of the 5 subscales of questionnaire was estimated. Data were collected from 286 farmers of 8 blocks of districts in West Bengal. One way Analysis of variance revealed significant mean differences across the blocks on all the 5 measures of self-efficacy. Farmers who used organic fertilizers were more self-efficacious than their counterparts. Self-efficacy was positively and significantly correlated with (a) Self-esteem clusters of GHQ-12; (b) Educational level; (c) Housing conditions; (d) Size of Farming Land area and (e) Multiple Crop production.

Debdulal Dutta Roy

Bullying in school and its Effect on Behavioural Aspects of School Students

The objective of this study is to assess the level of bullying on class VII and VIII students of Govt. and Govt. aided schools of Kolkata and students of rural and urban settings of Hooghly district of West Bengal. Resultants of bullying and personality of students may throw light to the future behavior of the students both in short term as well as in long term and even affect Academic Achievement. Data have been collected from two districts in West Bengal. It has been found out district level estimation of the incidents of bullying behavior of the two districts. The personality dimensions of assertiveness, intellectual curiosity and emotional stability were found to be negatively correlated with bullying behavior for all students irrespective of gender.

Rumki Gupta

Development of Questionnaire for the Assessment of Meaning in Life among Substance Users – Meaning beyond Substance Use

Perceived life meaningfulness in an important existential concept known for enhancing long term recovery from substance abuse. The present study is an attempt to further develop and validate the Perceived Life Meaningfulness Scale for substance users in recovery phase. The questionnaire was developed initially by Shaikh & Ghosh in 2010 on account of no empirical measure of meaning in life for substance users. Apart from giving brief overview of the original scale construction, the present study describes the validation of the reduced 15 item version. For the present study, 150 substance users from five different rehabilitation centers in and around Kolkata were approached. All the participants were males who underwent rehabilitation for alcohol and drugs dependence. Principal component analysis was done to determine construct validity of the questionnaire and Cronbach's alpha of the total scale score along with the sub scale scores demonstrated that the instrument was a reliable measure of life meaningfulness. Through the construction of the scale and its sub-dimensions, the present study gives a better understanding of life meaningfulness in context of substance use.

Fouzia Alsabah Shaikh and Anjali Ghosh

Psychological Determinants of Self Control over Addiction among Recovering Substance Users

One of the most alarming problems in the provision of care and d-addiction treatment to substance abusers in the inability to sustain prolonged recovery due to in adequate levels of self control over addictive substances like alcohol and narcotic drugs. Why self control over addiction has been found to have several determinants, the influence of a user's perceived social support and meaning of his / her own existence (both considered to be strong determinants of recovery for other illnesses) on self control have not been studied. The present research work therefore aims to examine the influence of perceived social support and meaning in life on perceived self-control over addiction among substance abusers. Questionnaires for assessment of abstinence support and meaning in life were developed on a sample of hundred substance users in recovery phase. Validation of the tools developed and examination of relationship of self-control if social support and meaning was done on a sample of 150 recovering substance users. Hierarchical regression analyses revealed emotional support, abstinence support, life meaningfulness along with age and depression to be significant predictors of self-control over addiction.

Fouzia Alsabah Shaikh and Anjali Ghosh

Relationship of Career stages with Locus of Control, Self-efficacy and Job satisfaction of Teachers

A literature review on the relationship between career stages and teachers' locus of control has been done. Super's career stage model in 1990 essentially posits four identifiable stages of a worker's career, namely, exploration, establishment, maintenance and disengagement. The model was suitably adapted for teachers by Huberman in 1989. He proposed career entry, stabilization, diversification and change, stocktaking and interrogations at mid-career, serenity and affective distance, conservatism, and disengagement. Huberman largely characterized the proposed career stages in terms of teachers'

individual behaviors and beliefs, not only about themselves and their work, but about students, other teachers and work environments. A pilot study has been conducted on 78 teachers of Kolkata. It has been found that career stages are significantly related with locus of control, teachers' self-efficacy and job satisfaction. Further data are being collected from different schools of different zones of Kolkata.

Rituparna Basak and Anjali Ghosh

Cognitive and social functioning in schizophrenia

Prognosis of schizophrenia depends on cognitive abilities and ability to make adequate social function. This study examined pattern of cognitive functions (attention, verbal working memory, stimulus inhibition) and social functioning of 50 schizophrenics from the post graduate hospitals of Kolkata. Results revealed (a) high impairment in cognitive functions and social functioning, and (b) significant positive correlation between the two variables.

Shivani Santosh and Debdulal Dutta Roy

Innovative climate of manufacturing organizations

Innovative climate perception is important for organizational growth and productivity. Current study aims at exploring perception of innovative climate by the managers of manufacturing organizations. Data were collected from 150 managers of manufacturing organizations in private and public sectors. Principal Component Analysis with varimax rotation extracted four factors namely – 1) innovative idea sharing and implementation, 2) experimenting, 3) infrastructure support and 4) participation to innovation. Results were explained in terms of management skills to make organization innovative.

Anurupa Kundu and Debdulal Dutta Roy

A People – Centric Approach in Adoption of Innovation

Based on literature review, several factors for adoption of innovation were identified. Finally, one people centric approach or Innovation-People-Adoption model was conceptualized. Data analysis is going on to validate the model.

Anurupa Kundu and Debdulal Dutta Roy

Mapping of Psychiatric symptoms

Mapping allows psychiatrist to form multiple clusters of symptoms on multidimensional plane based on their similarities and dissimilarities. Data were collected from 480 new psychiatric patients based on specific inclusion and exclusion criteria through checklist. Correspondence map extracted three clusters of symptoms as perceptual and thought disorganization complaints, stress complaints and depression complaints. Finally validation of clusters was examined.

Uday Sankar Mandal and Debdulal Dutta Roy

Economic behaviour of farmers

Aim of the study was to examine economic behaviour of farmers. Data were collected from 111 farmers about their demographic conditions, land type, years of experiences, income and expenditure. Results revealed (a) agricultural expenses were higher than non-agricultural expenses; (b) Expenses were high among more experienced farmers; (c) Income-saving positive correlation was relatively low among farmers having mono cropped lands.

Ayan Chakraborty, Sayan Chakraborty and Debdulal Dutta Roy

Analysis of Myanmar's capital expenditure

Inter-sectoral capital expenditure across 17 planning periods (from 1992 to 2009) was collected from records of Myanmar Government. Planning periods were clustered into three groups. Sector wise clusters differed across each cluster of planning periods. Sector cluster wise mean differences across

planning clusters revealed movement of economy from agricultural sector to non-agricultural sectors in Myanmar.

Thet Khaing Oo and Debdulal Dutta Roy

Sociological Research Unit

Research in the Unit during the year has encompassed a variety of topics under the broad rubric of studies of socio-economic development.

Economic conditions of a tribal village: report from Dungariya, Rajasthan

The research provides an analytical description of household economies in a village in southern Rajasthan. Dungariya is an underdeveloped village located in Kotra, one of the most underdeveloped tehsils of Udaipur district. It is a village in which people live in the depths of poverty, a village that is technologically stagnant, barely irrigated, and endowed with difficult, stony soil. It is a forest-fringe village. More than 60 years after Independence, it presents a case study of the worst consequences of the policies of the ruling classes in India. The village today is a site of acute poverty; however that poverty is measured -- whether in terms of incomes, education, health or access to the basic amenities of modern life.

V. K. Ramachandran

Is India Really a country of Low Income Inequality?

There is a misconception in the literature that income distribution in India is less unequal than, for instance, China or the countries of Latin America. This misconception is based on a comparison of like with unlike. Studies of income distribution for most countries are based – as they should be – on household *income* data, while corresponding studies of income distribution for India are based on household *consumption expenditure* data, and it is well known that consumption expenditure is, by its very nature, less unequally distributed than income. This research paper examines levels of household income inequality in rural India using data from in-depth village surveys conducted in eight villages from four States of the country. Although the data set is relatively small, the exercise is rather unique because of the lack of regular survey data on household incomes for rural India. The Gini coefficient is used as a summary measure of income inequality. Our estimates show high values of the Gini (close to 0.60) in these eight villages; these are comparable to levels reported for Latin America. Of the eight villages, inequality was relatively high in the three canal-irrigated villages

Madhura Swaminathan

Dalit Households in Village Economies

There is now important new descriptive-analytical writing on direct socio-economic discrimination. Professor Sukhadeo Thorat has pointed out that while there is a body of literature that documents discrimination and denial of civil liberties, there are very few studies by economists of market and non-market forms of discrimination and socio-economic exclusion. Scholars have emphasized the need for rigorous village-level micro-studies by economists of different aspects of Dalit households in village economies, and, specifically, the need for studies of the access of the victims of sectional deprivation to land, employment, credit, and other inputs in the contemporary context.

In response to this challenge, our group at the Sociological Research Unit, Indian Statistical Institute, Kolkata, together with students, teachers and research personnel from universities and colleges in different parts of India, has undertaken a series of village studies in different ago-ecological zones of the country. One of the objectives of these studies was to examine sectional deprivation in rural India, particularly with regard to the Dalit and Scheduled Tribe populations, women, specific minorities and the income-poor.

Research Activities

The research is now being compiled into a book. The papers in the book deal with access to land and other assets; land and property inequality; employment, earnings and incomes; some case studies of land movements; and other aspects of living standards, for example, education and household amenities (housing, electrification, sanitation).

V. K Ramachandran, Madhura Swaminathan, Aparajita Bakshi, Niladri Sekhar Dhar and Shamsher Singh

Occupational segregation in the factory sector

The research examines gender segregation in the Indian factory sector during the period from 1989-90 to 2000-2001. The analysis is based on data from the Annual Survey of Industries. The project critically evaluates ASI data. Estimates of Duncan and Duncan's segregation index show a decline in segregation over time at the all-India level. However, the picture is quite complex at the level of states. Segregation is related neither to the gender ratio nor to female labour force participation. At both national and state levels, food, beverages and tobacco products; textiles; non-metallic mineral products; wood and wood products; paper and paper related products were the industries with a higher than average share of female employment in all the years.

Molly Chattopadhyay and Sonali Chakraborty

Evaluation of child labour welfare programme through the study of Child Labour Schools in North 24 Parganas district, West Bengal (2009-2011)

The objective of this project is to understand and evaluate successes and failures in the implementation of child labour schools, a key component of the strategy to eliminate child labour in India by mainstreaming child workers in regular schools. In the first phase (2009-2010), a sample of five child labour schools from rural and urban areas of North 24 Parganas district was drawn. Data were then collected from 10 boys and 10 girls from each of the selected schools. The questionnaire covered child-related and household information. In the second phase (2010–2011), a complete list of children who had completed the three-year course in the sampled child labour welfare schools was made. For each of these children, information about their present status was collected. Currently, we are trying to interview children identified above. Data collection will be completed by March 2011.

Aniruddha Chakravarty

Statistical Quality Control and Operations Research Division

The Division comprises of eight SQC & OR Units located at Bangalore, Chennai, Coimbatore, Delhi, Hyderabad, Kolkata, Mumbai and Pune and the Central SQC (CSQC) Office located in the main campus at Baranagore. The CSQC Office functions as the office of the elected Head of the Division and co-ordinates various activities of the Division.

The activities of the division consist of consultancy and training, research with a focus on the applied one, academic teaching including conducting M.Tech. (QROR) programme at Kolkata and Part-Time Certificate course at Bangalore and Hyderabad. The faculty members of the division also teach in other academic programmes like B.Stat. and M.Stat. Supervision of Ph.D. thesis along with the dissertation and project work by M.Tech. (QROR) and M.Stat. students are another part of the responsibilities discharged by the divisional members.

The activities of the Division under different headings are furnished in the following.

SQC and OR Unit, Bangalore

Progress of Work: Six Sigma Initiatives

The present research work deals with the identification of critical success factors both in manufacturing and service sectors, which is important for a successful Six Sigma project and also evolving a methodology to measure the effectiveness of the project. A paper titled “Improving Efficiency & Effectiveness of APQP process by using DFSS Tools” has already been published in International Journal of Six Sigma and Competitive Advantage, 5, 3, 222-236, 2009. A paper titled “Six-Sigma Project Selection Methodology” has already been published in International Journal of Lean Six Sigma, 1, 4, 293-309, 2010. A part of the research will be in the direction improving process efficiency through measuring, identifying and isolating the unsafe working environment. A paper titled “Prevention of Industrial Accidents Using Six Sigma Approach” is sent for publication in the journal International Journal of Lean Six Sigma and is accepted.

Sanjit Ray

Model for Business Process Improvement through Statistical Techniques

Literature survey on the available methodology on process improvement was carried out to understand the nature of applications and models already available in business process improvement. So far, four articles got published and two got accepted for publication during this period of research. One such article which got accepted for publication in the journal “Production Planning and Control: The Management of Operations’’ is “Case Study in six-sigma methodology: manufacturing quality improvement and guidance for managers”.

E.V. Gijo

Developing Model for Business Process Improvement through Statistical Techniques

E V Gijo

SQC and OR Unit, Chennai

Stochastic Games

We considered certain mixtures of classes of Stochastic Games and gave sufficient conditions for these mixtures to possess the order field property. We show the sharpness of results with several examples.

G. Ravindran, T. Parthasarathy and K. Nagarajan

Semi-Definite Linear Complementarity Problem

We discuss the Complementarity Properties of Z and Lyapunov-like transformations on Symmetric Cones.

G. Ravindran and M.S.Gowda

SQC and OR Unit, Coimbatore

Reduction of Lotto Lot variation in YARN

India is the largest exporter of yarn in the International market and has a share of 25% in world cotton yarn exports. The various lots of same counts produced are varying depending on their environment and Raw materials. The Statistical Framework , to reduce the lot wise variation was found and implemented in one of the spinning plants and successfully implemented by A.Rajagopal. This resulted in “Continuous Customers Loyalty” even during the “Spiraling Cotton Price Recessive Season” of 2011, gaining rich name in the industrial Circles.

A. Rajagopal

Increasing the Test Case Productivity in Test Design Process for a Leading Health Care Projects in Software (MNC's)

Leading US health Care business customers need to increase the Test Case Design Productivity in eBIZ enhancement Project the Test case Productivity is defined by the customer according to the severity, the testing team could not design the test case as per the productivity expectation of the customers. There were incidents of variation between the scheduled time to design and actual time to design measured in terms of test case points, by Software Teams. The Test cases are prepared for Processing of Client Inputs.

The testing team consists of 5 team members. In the last 6 months, 3283 test cases have been produced with the total effort of 1297 man hours. The average productivity was 29 test cases per person day as against 40 test cases per person day. This is due to the excess test cases produced. This is not only affecting the efficiency of the testing team but also delays the service time to customer for releasing the test design. There will be a penalty clause for any delay in future. The Goal is enhancing the revenue turn over, the productivity needs to be increased from the existing 3.7 to 5 Test cases per person hour. The pain of the problem is the stress to the team lead and team members, over stay by the team members in order to complete the test design urgency, incompletion of assignment that may cause penalty in future, Poor customer relationship. The variation between Application, and Change request were carried out using Statistical Principles of Both ANOVA and Controls with Prioritization of Effort hours by Resource Team. The Analysis could identify the applications and the efforts required, for improvement. This could be focused and controlled increasing the Productivity by 31.6 %.

A. Rajagopal

Achieving world class Specification in Compacting in a Thermal Project for "Ground Preparation" in Civil Works

The Critical Characteristics of the Soil filling is Compaction percentage, it is the base of Quality in land filling site. In the Land filling the minimum specification, for compacting is 95 % on the reference Lab Compacting of 100%, as per Standards. The Thermal Power plant with BHEL and TNEB for 800 MW is proposed near Tuticorin. In the Thermal power project the critical areas such as Lay down, Main Plant, and Store yard are compacted to the Level of 97%. This enabled to achieve 8 sigma world class Standards. The project site could with stand Torrential rain and significantly improved by identifying Soil Classification, Water Pouring Procedures, No. of Rolling by compacting were optimized. The achieved average and variation was considered respectively. The Methodology of achieving compactness received appreciation from the Client.

A. Rajagopal

Reducing Resolution Time of Tickets in a Life Insurance Process

Reducing the Resolution time of Tickets in a Life Insurance process related to Production and Business support operations using Statistical model and Six Sigma Approach. The Software company business customers asked for early resolution of Ticket, though the tickets are classified by the customer according to Severity as agreed to supporting team and Customers. There were incidents of variation between Target time to fix and actual time to fix. In a period of one month it was found that almost 63 % of tickets exceeded the target time to fix and the difference was as much as 32732 hours for about 82 closed tickets in one month. The estimated time loss since the inception of contract (period of 10 Months) was about 327310 hours for the contract period Rs 392772 per annum.

The average ticket closing rate was 0.00106 tickets per hour or Mean Time to Fix (MTF) was 942 hours as against the Target time of 120 hours even in the least severity level. This resulted in backlog of 24 tickets noted during the period under study. This is not only affects the efficiency of supporting team but also delays the service time to customers. The supporting team has 5 members. The

supporting team and the customer were in the project for the last 10 months. Instead of reducing the Actual Time to Fix, the target time itself was not met. The problem is from the Month of May to June, it was found that the mean Time to Fix ticket was very high when compared to target specifications provided by the customer. The Objective was to reduce the excess time over Target time from the existing 74.4% to below 50% within 3 months by reducing the Mean Time to fix of the arrived Tickets from Business users. This will result in enhanced customer satisfaction. Using the Statistical Tools of identifying the underlying distribution , predicting the percentile point and improving the same using the Tools of Gemba Investigations, Stratifications, enabled to classify the Tickets more Prudently in order to pragmatically fix the Problems.

A. Rajagopal

SQC and OR Unit, Delhi

Mathematical Programming, Combinatorial Optimization, Linear Complementarity Problem(LCP) and its generalizations, Matrix Theory (Study of Matrix Classes useful in Complementarity, Optimization and Game Theory), Non-cooperative games, Algorithms for Stochastic Games.

S.K. Neogy

SQC and OR Unit, Hyderabad

Areas of research: Linear Complementarity Problem, Decision Support Systems, Six Sigma, DOE, SPC, Text Data Mining

SQC and OR Unit, Kolkata

In the literature of process capability indices, the indices applicable to symmetric specification regions outnumber those designed specially for asymmetric specification regions. An unified super-structure C"p (u; v) of such indices for univariate case has been discussed by Chen and Pearn [2001]. But, normally, most processes require several characteristics to be within the given specification simultaneously. This necessitates the study of mul-tivariate process capability indices (MPCI). In the present paper, we have proposed a multivariate analogue of C"p (u; v) and have studied some of its very crucial properties. Moreover, we have studied the threshold value of this newly developed index viz. CM(u; v) which makes the interpretation of the index easier. Also we proposed, for univariate case, a region within which the target value of the process can vary when C"p (u; v) attains 'just its threshold value' i.e. 1. This property of C"p (u; v) was not explored by Chen and Pearn [2001].

A.K. Chakraborty and Moutushi Chatterjee

Assessing capability of a process with circular tolerance region is a very practical problem. However, only a few process capability indices are available in the literature to address this problem. Most of these indices, in turn, make some assumptions like equality of variance as well as independence of the two axes of the circular tolerance region. Since these assumptions are not practically viable in most of the cases, we have proposed two new indices to deliver the good. Some properties of these indices and their threshold values have also been proposed to make them more suitable for practical application.

A.K. Chakraborty and Moutushi Chatterjee

Recurrent events modeling in presence of terminal events and covariates

Working in the area of shared frailty modeling of recurrent events and terminal event processes observed with covariates in an engineering product with covariates in presence of non-informative/

informative censoring. Copula analysis has been used to find presence of dependence structures among the covariates.

S.K.Majumdar and Sumana Das

Multiclass support vector machine classifiers

Working in the area classification of defects in multiple classes with the help of support vector machines and Relevance vector machines in Bayesian framework using mixed kernels.

S.K.Majumdar and Abhijit Ghosh

Modeling recurrent events of multiple types

Working in the area of recurrent events process modeling with multiple types of events observed continuous casting process of steel plates/sheets in presence of large number of covariates using support vector machines and multivariate copula analysis.

S.K.Majumdar and Kaushik Basu

Algorithm for mathematical programming problems with Hanson function

The class of invex functions is precisely the class of differentiable functions whose stationary points are global minimizers. We extend some of the important results obtained by Hanson and Martin to constrained minimization problems. An algorithm for solving mathematical programming problem involving Hanson functions is developed.

A.K. Das

On a subclass of (H-Φ)-convex function and its properties

In this study, we introduce *ώ*-preinvex and *ώ*-invex functions, generalizations of convex function and prove some results. All these generalizations are viewed as a subclass of *(H-Φ)*-convex functions in specialized form. These functions and their characterization are very important not only for solving optimization problems but also mathematical modelling of system in applied science.

A.K. Das

Generalized convex function under differentiability

Many generalizations of convex functions have been appeared in the literature such as invex function, preinvex function, b-vex function, b-preinvex function, (α, λ) convex function etc. The purpose of this study is to investigate the relationship among such generalizations under differentiability.

A.K. Das

On weak generalized positive subdefinite matrices and its properties

In this study, we introduce a weaker version of the class of generalized positive subdefinite matrices introduced by Crouzeix and Komlosi and obtain some properties on weak generalized positive subdefinite (WGPSBD) matrices. We show that this weaker class of matrices is also captured by row sufficient matrices introduced by Cottle et al. and show that for WGPSBD matrices under appropriate assumptions, the solution set of a linear complementarity problem is same as the set of Karush-Kuhn-Tucker (KKT)-stationary points of the corresponding quadratic programming problem.

A.K. Das

Some aspects on solving a transportation problem

We revisit some transportation problems which arise in sample surveys and other areas of statistics. The associated cost matrices of these transportation problems are of special structure. In these

applications, due to special structural property of the cost matrix, North West corner solution produces an optimal solution. We revisit some of these results. A weighted version of Konig-Egervary theorem and Hungarian method are also presented. This will be useful to obtain an instant solution in many applications of the transportation problem.

A.K. Das

Study on Some Implementation Issues of TQM in Higher Education and Other Service Sectors and Gap Analysis by Lean Management

Guidance has been provided to Mr. Debaprayag Chaudhuri for Ph.D. in Engineering at Jadavpur University. He will submit his thesis in this year (2011). The scope of this work primarily centers on evaluation of degree engineering colleges in West Bengal. Weak areas have been identified, benchmarking has been done and corrective measures have been suggested to attain the benchmark. In addition, a few financial institutions have been evaluated with regard to TQM implementation that helped to build up appropriate model to provide faster and better service to the customer.

Arup Ranjan Mukhopadhyay

Impact of Noise Quality due to Highway and Related Infrastructure Development: A Case Study of Construction of Second Vivekananda Bridge and Its New Approach Road

Guidance is being provided to Mr. Tarun Roy on the above topic for Ph.D. in Engineering at Jadavpur University. In particular, empirical data based studies have been carried out on honking and its influence on noise pollution and assessment of noise environment during construction of the Second Vivekananda Bridge and its new approach roads. The studies have dealt with extensively the measures of noise pollution in terms of equivalent sound energy level (Leq) as well as the noisiest situation that has been termed as L_{10}.

Arup Ranjan Mukhopadhyay

Study on Some Challenging Issues in Implementing Lean Six Sigma

Guidance is being provided to Mr. Ashok Sarkar, Technical Officer (Gr. I) who works at the SQC & OR Unit, Mumbai, Indian Statistical Institute, for Ph.D. in Engineering at Jadavpur University. This work is primarily concerned with improvement of service quality by appropriately identifying and reducing non-value adding activities, waste, work-in-progress inventory level etc. to build up appropriate process modeling and measures in Lean Six Sigma.

Arup Ranjan Mukhopadhyay

Nonparametric estimation of quality adjusted lifetime (QAL) distribution

A nonparametric estimate of QAL distribution in a three-state illness-death model when sojourn times in illness state and healthy state are dependent has been proposed. Three dependent models have been considered to describe the dependence between sojourn times in illness state and healthy state. In the proposed approach, the theoretical expression of the QAL distribution in terms of joint distribution of different health states under a specific dependent model has been derived. The estimate of the QAL distribution has been obtained by substituting the estimate of the joint distribution in the expression of the QAL distribution. The study of asymptotic properties of the proposed estimator is in progress.

Biswabrata Pradhan, Anup Dewanji (ASU) and Alok Goswami (SMU)

Discriminating between Poisson and Geometric distribution

The problem of discriminating between Poisson and Geometric distribution has been considered. The difference of the maximized log-likelihood functions has been used for discriminating the two

distributions. The asymptotic distribution of the discrimination statistic has been derived. Numerical study is in progress.

Biswabrata Pradhan and Debasis Kundu

Control chart Using g and h distribution

Traditional control chart is based on the assumption of normality. In many practical situation assumption of normality is violated. Under these situations, the use of these traditional control chart give erroneous conclusion. For handling non-normal data one approach is use of non-parametric control charts which are not so efficient. Another approach is to use generalized distribution. In this work we have shown how univariate g and h distribution can be used to handle non-normal data. We have developed control chart using univariate g and h distribution and evaluated its performance under different non-normal distribution and compared it with control chart using exact probability limits.

N. Das

Control Chart for Controlling Variability Based on the Robust Estimators of Scale

Control chart is used to detect whether there is any assignable cause of variation. $\bar{x}$ - chart is used to detect the change in process mean whereas S chart is used to detect the same in process variability. Both the charts are assuming normality assumption. S chart is based on sample standard deviation which is indeed an unbiased estimator of population standard deviation σ but is highly affected by the violation of normality assumption. In this work, we have proposed some alternatives of S chart based on some robust estimate of scale parameters. We have also shown the performance of the proposed control charts and compared their performance with that of S chart for different non-normal distribution.

N. Das

Use of SPC technique in the field of reliability and maintenance engineering

Control chart is a well-known statistical process control technique used to monitor quality characteristic in manufacturing industry. It is generally used to improve product characteristics by reducing variability. In the recent past, research is going on to apply this technique in the field of reliability and maintenance engineering with the objective to monitor the failure process of a system. In this work, we attempted to show how statistical process control is used to control the time between failures of some machine with some real life data set. We have used Weibull distribution to model the failure data and developed control chart based on this distribution to monitor time between failures of a vertical boring machine.

N. Das

Multi-objective Bacterial Swarm Optimization (MOBSO): a Hybrid Approach

The ever-growing use of artificial swarm behavior has shown great promise to improve upon the performance of conventional evolutionary MOO based on genetic algorithms employing fitness based ranking schemes to the entire population in each generation. In this work we have made an endeavour to minimize the computational burden, associated with global ranking methods and local selection modules used in many multi-objective particle swarm optimizers. Two different swarm strategies were employed for global and local search respectively using particle swarms and bacterial chemotaxis. We have shown comparative improvements of the proposed method, with a benchmark evolutionary MOO method, NSGA-II. The study also highlights the reduction in computational complexity for large population.

Prasun Das

Rough set based feature selection using bacterial foraging optimization

We propose a new feature selection strategy based on rough sets and bacterial foraging optimization algorithm. The study gives an algorithm for this purpose, implemented in matlab and also shows the implementation on two standard datasets. Inclusion of cell-to-cell attractant function in the algorithm can lead to a better solution. Some parameters can be made to change dynamically which can help in faster convergence to the optima.

Prasun Das

Multi-response optimization in determining optimal factor setting

Most of the existing multi-response optimization methods determine the optimal alternative, not the optimal factor setting. This study suggests a way to choose the best alternative and also to determine the optimal factor setting under the multi-criteria environment. We have developed a distance function which measures the distance between two instances having multiple responses of different types. The new method is robust, easy to understand and requires less information. Two real-life problems have been solved using the proposed method. Performance of the proposed method is compared with existing methods and with experimental data.

Prasun Das

Detection of differentially co-expressed genes from microarray experiment: A data mining approach

Large-scale biological experiment involves monitoring the expression levels of thousands of genes simultaneously under a particular/different condition(s), called gene expression analysis. This study concentrates more on biological aspects rather mathematically/statistically correlated genes to quantify co-expression of genes, which are highly deviated from reference gene expression profile. We introduce a measure called, ***d****is****s****im* which takes care of both correlation and deviation to quantify co-expression between two gene expression profiles without losing biological importance. A new clustering method is used here to demonstrate how the proposed measure performs better as compared to several existing ones based on a microarray data set of plague disease. The study can be extended for non-identical treatments and by looking at biological importance of genes.

Prasun Das and Sanghamitra Bandyopadhyay

Design of controller for mixed data: A composite fuzzy-neural approach

The real life data set does not necessarily have to be continuous in nature, rather often mixed with categorical variables which are discrete in nature. Retaining information of the original categorical variables appears to be difficult in a encoder in use at times. This study proposes a methodology to design an online controller after processing FIS for categorical inputs and feedforward MLP neural network for continuous inputs simultaneously. The output of each system is connected through a dynamic linear filter to predict the ultimate response. The system has been proven more efficient as compared to existing methods in this domain. However, establishing interaction between the categorical and the continuous inputs through TSK-ANFIS based learning rule is kept as a future challenge for this work.

Prasun Das

Design of rough set based RA-order algorithm for assessing customer satisfaction

Assessment of customer satisfaction is of immense importance for an organization to develop and sustain in a competitive market. Rough set deals with the notion of vagueness in terms of approximations and therefore gives an opportunity to analyze customer survey database which is mostly qualitative in nature. Many methodologies have been developed to quantify the measure of customer satisfaction. In this work, an attempt has been made to develop a rough set based model for assessing overall customer satisfaction for an organization as well as that of a customer himself. Two new measures of customer satisfaction index have been proposed. Sensitivity analysis is performed to

analyze how well the proposed measures can detect change in the customer behavior. Finally, comparison of the proposed model with other existing models is made.

Prasun Das

Design of features and developing an approach for modelling on promotion criteria in academic institutions

A promotion is a career opportunity for an employee that involves greater responsibilities, and may also involve an increase in salary, and a change in designation. A faculty of an academic institution may be considered for promotion on the basis of his/her past records, performance as a researcher/consultant/teacher and other ancillary works in the present position, and qualification to perform the duties for the higher position. This study proposes an evaluation system for necessary promotion of an employee using fuzzy set theory for these behavioural observations where inputs for the rule-based FIS structure are ordinal in nature. An integrated two-layered FIS is designed taking into consideration all the promotional criteria (features). The defuzzified output is compared with a laid-down standard to conclude whether a particular faculty has to be recommended for promotion. Optimization of the rule base parametric system using Mamdani ANFIS is kept as future plan of work.

Prasun Das

Identification of quality attributes of e-Learning product quality and developing quality standard in Indian context

Learning is that which enables us to participate successfully in our life and in the environments that matter to us. Since an educational process can be subdivided into five sub-processes i.e. context-quality, structure-quality, process-quality, output-quality or impact-quality; the scope of the proposed research will be restricted within the quality assurance of eLearning product. In the proposed research, the main objective is to find out the quality attributes for the eLearning. In the first phase of the study, attempts will be made to collect the works and segregate these in the two main areas- content quality and process quality. In the second phase, the interrelation between the content quality and process quality attribute matrix will be tried to develop. The last phase of the research, based on the priorities attributes, will be on developing quality standards for eLearning product quality in Indian context. An attempt has already been made to find out the defect generation trend in e-Learning product development environment and steps for prevention.

Prasun Das and S. Roy

Six Sigma Initiatives: Critical Success Factors and Effectiveness Measurement

The present research work deals with the identification of critical success factors both in manufacturing and service sectors, which is important for a successful Six Sigma project and also evolving a methodology to measure the efficiency and effectiveness of the project. A fuzzy logic based measurement system for measuring the effectiveness of Six Sigma project is in the development stage. The major research is being carried out in the areas of six sigma initiatives - DFSS for new/modified product and processes, and DMAIC for existing product and processes – about its objective, implementation and effectiveness measurement, and method for improvement. The other part of this research in the direction of improving process efficiency through measuring, identifying and isolating the unsafe working environment is in progress.

Prasun Das and Sanjit Ray

Materials Informatics for ABO_3 type Perovskite Compounds

Design of materials through traditional exhaustive experimentation and knowledge extraction for development of theory is expensive and time consuming. A process called ‘materials informatics’ allows a designer to review complex, multiscale information in a high-throughput, statistically robust, and yet physically meaningful manner. The content of the research work was limited to development of computational methodologies in materials science and engineering with the help of data mining

techniques which are blend of statistics, machine learning and artificial intelligence, designed for pattern recognition and prediction through the extraction of knowledge from the data. Three studies on ABO_3 type Perovskite compounds were carried out so far to address new ways of integrating computational materials science models related to formability and piezoelectric properties with the help of data mining/statistical learning methods to develop predictive models and search for feature selection/extraction for the design of new, chemically complex compounds.

Prasun Das and K. Rajan

Sliver defects in cold rolled IF-steel Sheets - a Data Mining Approach

There is an ongoing demand of Interstitial-free (IF) steel for automotive industry during past few years due to their high formability and improved surface quality. This study was aimed at searching the root cause of a serious industrial problem of sliver formation in cold rolled IF steel sheets, being faced by all sheet makers all over the world. The 45 variables, taken from all possible compositional and process parameters from steel making, continuous casting, hot rolling, could be reduced to significant 21 based on contribution measures of features using ANN. Variables viz. S and N content of the steel, oxide contents in the slag, oxygen content in the reheating furnace and mould level fluctuations during casting are found to have significant contribution in sliver formation and its severity as identified through PCA and correlation maps. Decision trees have been used to generate classification rule, including posterior probabilities of cases and the order of importance of variables. All these analyses show the necessity to develop the steel as clean as possible in cast condition and to reduce formation of oxide layers before and during hot rolling.

Prasun Das and S. Datta

Multi-response optimization of multi-characteristic processes

Depending on the types of the multiple responses requiring optimization, industrial processes can be categorized into different groups. For example, there are processes where a) all the responses are static continuous variables, b) all the responses are static continuous variables and correlated, c) some responses are static continuous variables and some are ordered categorical variable d) all the responses are dynamic continuous variables and many others. The aims of the current research are to identify the most suitable method for different process groups and then to explore the possibilities of developing new methodologies which can give better optimization performance than the identified most suitable existing method for a process group. The optimization methods for the processes requiring simultaneous optimization of multiple correlated static responses have been studied in details. It has been found that principal component analysis (PCA)-based utility theory approach results in the best optimization performance for this process group.

S.K. Gauri, Rina Chakrovorty and Shankar Chakraborty

An expert system for control chart pattern recognition

An extensive research work has been carried out and algorithm for recognition of nine main types of CCPs has been developed. An expert system is developed in Visual BASIC 6 which is capable to plot the control chart, compute the control limits, identify the control chart pattern, calculate the process capability index, determine the maximum run length and identify the starting point of the maximum run length. It uses an optimal set of only seven shape features to identify nine most commonly observed control chart patterns. The major advantage of this expert system is that it can not only recognize a particular control chart pattern, but also display various assignable causes behind that pattern along with the necessary remedial actions to help the quality control practitioner for effective decision-making. It will be widely acceptable to any manufacturing process to prevent production of defective parts/products while improving the overall quality level. It will also act as a poka-yoke device for any manufacturing industry to achieve the goal of zero defect and total quality management.

Monark Bag, S.K. Gauri and Shankar Chakraborty

Scarf's Generalizations of Linear Complementarity Problem

In this research work we study Scarf's generalization of the linear complementarity problem and formulate this as a vertical linear complementarity problem. We used neural network dynamics to solve Scarf's complementarity problem involving a vertical block matrix. Using few examples of various dimensions, we have shown the processability of the proposed algorithm.

S.K. Neogy, A.K. Das and A. Gupta

Computation of Value Vector and Optimal Strategies for Discounted and Undiscounted Class of Structured Stochastic Game using Neural Network Approach

In this research work, we present a neural network approach for solving stochastic game problems. The neural network model is derived from the reformulation of the problem of computing value vector and optimal strategies of the class of stochastic game problem as generalized linear complementarity problem of Cottle and Dantzig. The existence and the convergence of the trajectory of the neural network are also addressed. Corresponding simulation results are reported. Numerical simulation results also showed that the proposed network model is feasible and efficient.

S.K. Neogy, A.K. Das and A. Gupta

SQC and OR Unit, Mumbai

Development of Brand Trust Index

Brand Trust, is defined as the 'soul of the primary bond of engagement'. The complexity of the bond is measured through survey and an index is developed to compare the trust each brand enjoyed.

Ashok Sarkar and Sagar Sikder

Library, Documentation and Information Sciences Division

The Library, Documentation and Information Science Division comprises the Central Library at Kolkata, Centre Libraries at Delhi and Bangalore, and the Prasanta Chandra Mahalanobis Memorial Museum and Archives at the headquarter. The Division is the most important central facility of the Institute.

Library, Kolkata

The Central Library occupies a unique place in academic and research activities of the Institute. The Central Library moved to its present location in 1978, and it occupies 4 floors (56000sq.ft) of a ten-storied building at Calcutta. The Central Library seeks to:

- Meet the informational, educational, recreational, and cultural interests and needs of the user community by providing timely access to print and non-print resources appropriate to those needs.
- Encourage and facilitate reading, literacy and lifelong learning by supplying resources in a variety of formats designed to interest, inform, and enlighten.
- Protect the public's right to know by providing equal access to information needed for informed and effective daily living, decision making, problem solving and thoughtful participation in civic/community affairs.
- Provide the highest quality service and to organize and display the collection for easy, open access by all.
- Maintain publication exchange programme of the Institute with regional, international, national, and foreign institutions and organizations.
- Continue to function as the Eastern Regional Library of the National Board of Higher Mathematics [NBHM], Department of Atomic Energy, Government of India since 1989.

Over the years, the ISI Central Library has attained the distinction of being one of the richest libraries in India in the areas of mathematics, statistics, economics, theoretical computer science and related areas. To achieve the goals of the Library, following activities were undertaken during the year under report:

Collection Development:
The Library maintains an excellent collection of books, journals, reports, rare and special collection, government publications, data-books, theses and other documents/ materials in print and electronic formats. During the year under report, the library accessioned 1100 books out of which 995 were purchased from ISI budget and 105 from NBHM grant, while 52 books were received on complimentary basis. Added 01 book to the project collection. The Library also accessioned 912 bound volumes of journals and subscribed to 540 scholarly journal titles in print. More than 52 journal titles were received as complimentary and 97 titles in exchange with Sankhya. The library received and processed more than 11000 loose issues of journals. It classified and catalogued 1040 new books and filed 4260 computer printed catalogue cards. It also processed 150 titles on government reports/data-books etc. 212 government reports has been added. Beside this, the library has added a collection of 188 books, mainly in English, Bengali and Hindi on literature, humanities, travel, health and recreation in its Statistical Workers' Circulating Library totaling its collection to **38713.**

In addition to this, the library has about 32000 reprints. Thus the total collection of the library stands at around 354660.

E-Resources:
The library has a good collection of electronic resources on different media and has access to several online journals/databases. During the year under report, the library has added approximately 600 ebooks, 54 CDs & floppies containing books and CDs on statistical data. Thus, the total collection of CDs has risen to 1007. The library has provided the online access to about 2500+ full-text journals. It has renewed the online database like MathSciNet, ScienceDirect and Springer Link through consortia. It has also subscribed to the IEL online of the IEEE/IEE publications, ACM Digital Library and Current Index to Statistics (CIS) on Web. The library has also subscribed to few statistical data sources available on CDs.

Publications Exchange Programme: The library maintains the publication exchange programme of 'Sankhya - the Indian Journal of Statistics' with 57 national and 23 international institutions/organizations. The 23 international agencies are from various countries of the world such as Bangladesh, Belgium, Brazil, Canada, China, Taiwan, Croatia, Czech Republic, Denmark, France, Hungary, Italy, Japan, Pakistan, Poland, Romania, Russia, Slovakia, Spain, Switzerland, Thailand, UK and USA. In exchange Library has received 97 titles during the reporting period.

Membership: Membership of the ISI-Library is restricted to persons with post-graduate or equivalent academic qualification, interested in the objectives of the Institute. Faculty members, research scholars, students, research associates, visiting scientists, ISEC trainees, project-linked staff, project assistants, ISI-employees, outside students and the Institute members are eligible for the membership of the Institute Library. However, they have to apply for the membership of the library and receive a bar-coded Library Card. During this period, library membership was given to 400 persons and 820 readers were given special permission to use the library for a short period. Currently the total number of library member rose to 2480. Total number of members including staff, students and research scholars of the Institute rose to 960 in its workers' circulating library.

Services: The ISI-Library, since its inception has been providing a variety of library and information services to its users. The services presently being provided include;

Web-OPAC- Members use this facility to browse and search the database to see the status of a document including their own transactions.

(i) Lending/Document Delivery Service: During this period, 95964 books and other documents were issued to the user on loan and reference. Publications from Government of India and other International Organization and data CDs, were issued to users for reference purpose. The library supported 2000 pages of reprint requests from journal articles. It provided email-based reminder services like 7-day advance alert, long overdue notice and check-in information. 20000 books from the workers' circulating library were issued for lending and reference during this period.

(ii) Inter-library loan: 35 Books and journals were borrowed from other libraries, while 103 books and journals were lent to other libraries.

(iii) Current Awareness Service: 12 monthly lists of current additions to the library were made available online.

(iv) Self-Photocopying Service: The library provided the Self-photocopying service in its periodical section, which was available everyday throughout the library hours. During this period 18000 pages were photocopied from the journals.

(v) Electronic Document Delivery Service: Full-text articles and/or bibliographical data were provided through email from online resources. Besides electronic document delivery, 3124 pages of printouts were also supplied against demand.

(vi) Online Full-Text Access to Journals/ Database: During the period under review, the library has provided services from more than 2500+ online journals and major databases like MathSciNet, Econlit, ScienceDirect, Springer Link, IEL Online (IEEE/IEE Electronic Library), ACM Digital Library, CIS on WEB, OUP journal online consortia: JSYOR (Life science). The online access is available through campus-wide network.

(vii) Reprographic & Photographic Service: During the year, it provided around 403198 pages of photocopies, 288 graphic designs, 3890 scanned pages, 3708 pages of color and b/w pages of print outs, 6500+ copies of plates, 6167 pages of color photocopies, and 210 spiral bindings. Laminated 690 pages.

(viii) Documentation Service: A searchable bibliographic database has been prepared on scientific contributions made by the ISI scientists on all subject fields since 1934. The entries are currently being subjected to editing.

(ix) General Enquiry Assistance & Consultation Service.
Assistance extended to 20 participants of the Winter School, 11 participants of NBHM Nurture Programme, 10 INSA-NASI Summer Research School participants and visiting students of of Mizoram University and North East Hill University.

Special Initiatives:

(i) Consortia arrangements: During the reporting year, the Library has further strengthened the consortia initiative to enhance the electronic collection and online access to scholarly resources to cope up with the increasing subscription cost and diminishing budget.

(ii) Preservation and conservation: Total 695 books, 1000 journals were bound. Lamination and de-acidification of 11 rare books of 1200 pages, fumigation of 125 books, photocopying of 4 rare and out-of-print books were executed during this period.

(iii) Institutional Repository (IR): A prototype of IR of ISI has been created. Currently it covers scientific writings of Professor P.C. Mahalanobis, full-text of 1700+ ISI research papers, full text of all convocation addresses, ISI Annual Report from 1933to 2008 and some Ph.D thesis.

(iv)Digitization: During this period, 10000 pages of Census Reports, Working papers, Technical Reports etc have been digitized and are currently available on compact Disks. These will be made available on the Web after the completion of the work.

Prasanta Chandra Mahalanobis Memorial Museum and Archives

The Museum and Archives carried out regular up keeping programmed for 752 exhibits through 91 panels and a collection of artifacts related to Professor. Mahalanobis displayed in the ground floor, chatal, and Professor's residence along with the pest control programme for the whole building of Amrapali. Among other programmes it had taken up the work of restoration of old film rolls, audio spools etc. through CD conversion (2 nos. audio spools & 3 nos. film rolls), scanning of archival documents (3,500 nos. of document) and conservation of archival materials (4,000 documents). Existing computerized fire alarm and display security system has been enhanced. To maintain the standard of display quality and techniques an up gradation programmed had also been taken up.

School students from other states, as well from the city itself visited the museums. The eminent persons and scientists, college and university students were among the visitors of the museum. Scholars and researchers from India and Abroad consulted our archival collection for reference.

For the up gradation of archival data-base: Encoded Archival Description" (EAD) module has been developed and implemented to the existing software.

Library, Delhi

Indian Statistical Institute, Delhi Centre, maintains an academic library, which aims to be a leading library in the fields of Economics, Mathematics, Statistics, Operations Research and Statistical Quality Control. The library caters mainly to the needs of bonafide students, scholars and staff of the Institute. However, it is also open for reference to academic and research users of other educational and scientific institutions of the city and its neighboring regions.

It is an automated library with an extensive collection of books, journals, CDs, reports, govt. publications and other documents in print and electronic formats. Some of the main activities of the library during the period under review were as under:

COLLECTION DEVELOPMENT

BOOKS: The library purchased 300 books, during the period April 01, 2010 to March 31, 2011 both from the regular ISI and NBHM funds. Received 74 books as gift. Thus raising the stock to 48017 volumes (Books + Journals).

JOURNALS: During the period under review 265 titles of journals, both foreign as well as Indian have been renewed. 23 journals on gratis and 10 journals in exchange are being received in the library from various sources. Over 500 journals are accessible online due to consortia based subscription initiated by Delhi Centre Library.

CD-ROMs: The library has more than 500 CD-ROMs of different reference books and journals including EconLit and Current Index to Statistics (C.I.S.) etc.

ONLINE RESOURCES:
Following Online databases have been renewed:

Research Activities

(i) "EconLit" (fundamental research tool in economics with bibliographic citations and abstracts database) published by American Economic Association.
(ii) "SIAM Academic Membership" for getting Print + Online journals.
(iii) "Current Index to Statistics" (Web Access Version) bibliographic database in Statistics, Probability and related fields published by American Statistical Association has been renewed.

CONSORTIA BASED SUBSCRIPTION:
During the period under review, following Consortia based Online subscriptions have been renewed:
(i) ScienceDirect (Consortia of three ISIs) Kolkata, Delhi and Bangalore with 142 full texts Elsevier Science group journals from year 1995.
(ii) SpringerLink (Consortia of three ISIs) for 96 Springer Group journals from year 1997.
(iii) J-STOR (Consortia of three ISIs) for 184 full text back volumes from Volume 1 onwards.
(iv) Oxford University Press Online Journals (Consortia of threec ISIs) for 54 full text journals from year 1996.
(v) MathSciNet (AMS) (Consortia of 22 institutions including three ISIs: Kolkata, Delhi and Bangalore) containing Bibliographic data and reviews from year 1940.

EXCHANGE PROGRAMME:
Exchange program established with seven scientific institutions in the regions of China, Korea, Netherlands, Poland, Spain and Vietnam for getting their publications in exchange to our journal 'Sankhya'- Indian Journal of Statistics and "Texts and Readings in Mathematics" (book series).

SERVICES:
Circulation Services: During the period April 1st 2010 to March 31, 2011, 133 members, availed the lending facilities as permanent members of the library, whereas 370 members availed reference facilities of the library. More than 5200 publications have been circulated among the members.

Reprographic Services: During the period April 1, 2010 to March 30, 2011, more than 13790 pages have been Xeroxed and made available to users of the library and outsiders. Xerox facilities were also provided to 70 research scholars of neighbouring Institutes under NBHM programme.

ELECTRONIC DOCUMENT DELIVERY SERVICE:
In addition to Xerox facilities, 350 Full texts articles (PDF files) were provided through email from online journals/databases under NBHM programme.

CURRENT AWARENESS SERVICE:
The following lists were brought out regularly from the library:
(i) Monthly list of current periodicals (Online)
(ii) New additions (books) Online

Brought out "*Current Contents of Journals"*, by photocopying the contents page of each journal received at ISI, Delhi Centre library, during a specified period and distributed to 33 departments of Statistics and Mathematics of universities and institutions in the Northern region under NBHM programme.

LIBRARY WEB-OPAC (BOOKS):
The users have been given access to the complete Catalogue of the holdings through CATALOGUE-OPAC. A Web search engine has been provided in the library Home page.

LIBSYS- OPAC:
The internal user can use LIBSYS OPAC for the access of Catalogue by Author, Title and Publisher, which is only available in the campus LAN.

JOURNALS ACCESS FROM OUTSIDE ISI:

Link has been provided to access the full text of journals from outside ISI Delhi. Outside user can access full text by using Username and Password, available with Library Staff.

LIBRARY TRAINEES:
Two Library Trainees with nominal remuneration were appointed for a period of ten months to undergo training in the practical aspects.

Library, Bangalore

Indian Statistical Institute Bangalore Centre Library is aiming to be identified as a model library in the Indian academic scenario. The library is providing many modern library services using Internet and they are popularly known as Web based information services. Bangalore centre Library has recently tried to initiate Lib 2.0 applications where in users are made more interactive. The library has developed a very distinguished collection in the different knowledge domains namely Mathematics, Statistics, Economics, Quality control and Operations Research and Library and information Science. Latest addition to this list is neural networks, spatial data analysis and communication networks. Various services are designed to meet the information needs of the faculty members, students, research scholars and visiting scientists. Walk-in users from other research institutes and universities are also permitted to use the reading facility of the library.

The following activities were undertaken by the library to achieve the aim during the year April 2010-March 2011.

Collection Development
In order to meet the Collection development needs a "BOOK EXHIBITION" was arranged on 3-4thth Feb, 2011 at the library premises.

The library purchased 584 books during this period of the report and thus amounting to a total of 29,781 accessioned books in the library. The library received 71 gratis books as complimentary. the total books accessioned on gratis are 2155. The library subscribed to 304 journals . 12 journal titles were subscribed from NBHM grants. Additionally Library has subscribed to "IEL ONLINE" which gives access to whole lot of journals and technical reports published by IEEE. During this period 519 bound volumes were added to the shelf and thereby leading to 15577 bound volumes in the library. 39 E-Books from World Scientific Publishing is the latest addition to the Collection of Bangalore Centre Library.

Technical Processing
Total number of books classified and catalogued during this period is 250.

Membership
134 registered users enjoyed the library facilities and the services. Also these facilities were extended to 1860 walk-in users during this period.

Library Services

Current Content Service
Content pages of around 960 loose issues (subscribed Journals) have been scanned to provide this service at ISIBC.

Circulation Service
Around 6120 books and 700 bound volumes of journals were circulated during this period. 1525 loose issues of journals were issued overnight to users.

Inter Library Loan Service
ISI Bangalore Central Library has been identified as one of the best libraries in the select fields of study. As a result and also due to good liaison amongst local libraries the library has been involving itself in providing inter library loan service. Library has attended 210 inter library loan requests. The library has borrowed 15 books from the other research libraries on ILL.

Document Delivery Service
Under this service around 110 documents in pdf format were downloaded and supplied to the registered users from e-versions of the journals.

Reprographic Service
During this period 66,275 xerox copies were supplied to the library users.

Web based library services
The library has devised various services using World Wide Web. They are all accessible at http://www.isibang.ac.in/library. As a result of these services the library users have online full text access to around 450 journals. Most of them are made accessible on account of ISI Consortia. The library also provides access to various A & I services such as LISA, Mathscinet, Current index to statistics, Web of Science. A virtual library in Mathematics has been designed for the benefit of the users. Additionally library has enumerated lists of open access journals in Mathematics & Statistics (139 titles), Library & Information Science (67 titles) and Economics (73 titles). They are all made accessible through the library portal.

Center for Soft Computing Research: A National Facility

Image Processing

Graph theoretic approaches for image segmentation have been widely studied in literature. Many such techniques are based on graph theoretic formulation of visual grouping of pixels. In general, the said formulation considers similarity and proximity among image pixels. A study has been carried out on ways to compute the similarity and it has been suggested that consideration of image structure in the computation might prove useful. A few approaches to capture / model image structure have been suggested based on fuzzy sets. Experimental results have shown the benefits of considering image structure in graph theoretic segmentation of grayscale images.

D. Sen, N. Gupta and S. K. Pal

A methodology using Multi Objective Evolutionary Algorithm (MOEA) is developed for digital watermarking in spatial domain. The work demonstrates the suitability of MOEA in the automatic selection of modulation operator by optimizing multiple evaluation functions such as imperceptibility and robustness. The effectiveness of MOEA is exploited to find a number of solutions in the Pareto-optimal front. The performance of the solutions is analyzed using the image characteristics curve (ICC) that is introduced following the concept of operating characteristics curve (OCC).

D. Bhandari and S. K. Pal

Reference points play an important role in the field of fingerprint recognition. It is mainly used for fingerprint classification and fingerprint matching. There are many methods proposed for fingerprint reference point detection like Poincare Index technique, Direction curvature technique. A method has been developed that detects the reference points considering the uncertainty arising from imperfection of fingerprint reference point position.

A. Maiti and M. K. Kundu

Video Analysis

A video summary is ideally a compact representation of the longer original video. By putting only the necessary information in a compact representation, a video summary helps in easier perception of the video. It relives the burden of processing huge chunk of audio-visual information. Works are being carried out to achieve a new video summarization technique that considers relevance of a combination of frames in the video. If the relevance is found to be less, those frames will be removed from the original video. Goal is to find the largest sequence of such frames. Within this basic goal of work, a human visual system inspired gist-feature representation of a frame is also being studied.

R. Pal, A. Ghosh and S. K. Pal

Evolutionary Algorithms:

An optimal stopping criteria based on a statistical measure for elitist model of genetic algorithms (GA) is determined. Theoretical basis of using the proposed measures as stopping criteria has also been established. It eliminates heuristic decision making, is easy to implement and does not need any auxiliary information. The concept has been extended to introduce a stopping criterion for Multi-Objective Genetic Algorithms (MOGA). In this context, a merit function is proposed that defines the suitability of a solution for the multi-objective problem.

D. Bhandari, C. A. Murthy and S. K. Pal

Granular Computing

Granular Computing (GrC) provides an information processing framework where computation and operations are performed on information granules (objects grouped together or clump of objects). The main task to be focused is to construct and describe information granules, which play essential roles in human cognition. Generation of informative granules lead to a better retrieval of information and are useful for pattern classification. Granules can be formed using soft computing techniques such as fuzzy sets, rough sets, fuzzy-rough sets, rough-fuzzy sets. GrC handles uncertain and incomplete information of real life data sets by differentiating distinct elements of data. The difference here gives classification of data, cluster of data and other pattern recognition techniques. Two projects are going on.

We developed a new way of granular computing using fuzzy rough sets, based on a fuzzy tolerance relation, which are integrated with a neural network such as multi-layer perceptron for fuzzy classification of real life ambiguous data. The effectiveness of the resulting network, called a fuzzy rough granular neural network (FRGNN), is demonstrated on various data sets. The superiority of the algorithm, in terms of classification, precision, recall and average Micro f-measure, is established.

G. Avatharam and S. K. Pal

We are working in the generation of informative granules and information retrieval methods using soft computing techniques. At present, we have developed two models for pattern classification based on granular space. The models use the merits of fuzzy sets, rough sets, neural networks and wavelet transform, and their hybridization. The superiority of these developed models to similar other methods is established with several benchmark data sets including web-mining. Further, we are looking into different aspects of granular computing for performance improvement.

S. K. Meher and S. K. Pal

Computational Theory of Perception and *f*-granulation:

Computational Theory of Perception (CTP) deals with computation based on perception rather than measurements. It is inspired by the remarkable human capability to perform a wide variety of physical and mental tasks, including recognition, without any measurements and computations. Perceptions are intrinsically imprecise. Their boundaries are ill-defined and the attributes they can take are granules. In other words, perceptions are *f*-granular. Granulation is also a computational paradigm among others such as self-organization, self-replication, evolution, perception, functioning of brain, group behavior, cell membranes, and morphogenesis which are abstracted from natural phenomena. The theory of

rough-fuzzy computing has a significant role in modeling the fuzzy-granulation (*f*-granulation) characteristics of CTP. Research is being conducted in this direction for performing various tasks.

S.K. Pal

Bioinformatics

A common problem for researchers working with RNA is to choose a suitable technique to determine the three-dimensional structure of the molecule given just the nucleic acid sequence. In this regard, application and importance of soft computing techniques like artificial neural networks (ANN), genetic algorithms (GAs) and simulated annealing (SA) to analyze and interpret RNA sequence data for predicting RNA secondary structure have been investigated. The learning ability of ANN, and searching potential of GAs and SA have been found to be mainly utilized in the process. A new weighted power scoring framework is developed for predicting the function of unclassified yeast genes where, the weights are adaptively estimated by using the functional classification of known yeast genes and by combining the information about genes arising from microarray, protein sequences, protein-protein interaction, phenotypic profiles and gene pathway information. Functional categories of 19 unclassified Yeast genes are also predicted.

S.S. Ray and S.K. Pal

Feature selection with unsupervised learning is a difficult problem, with neither class labels present nor any guidance available to the search. Determining the optimal number of clusters is another major issue, and has an impact on the resulting output. A novel unsupervised feature selection algorithm, governed by biological knowledge, is developed. Incorporation of biological knowledge in the form of gene ontology analysis helps in the automated selection of biologically meaningful partitions. The algorithm mainly emphasize the utility of incorporating biological knowledge for dimensionality reduction.The superiority of the algorithm in terms of performance is established on high-dimensional Yeast cell-cycle, Human Multiple Tissues and Leukemia microarray data.

S. Ghosh and S. Mitra

Micro RNA (miRNA) is one kind of non-coding RNA, generally responsible for the expression of some basic characteristic (such as embryonic development, cell proliferation, apoptosis etc.) in all the living organisms containing eukaryotic cell. It consists of 22 nucleotides (22 nt), works directly on the messenger RNA (mRNA), and also plays an important role in the disease cancer. Due to the dysregulation of miRNA/s cells fail to exit from cell cycle and continue the cell division process, which results in uncontrollable cell division (sign of cancer). Investigations are going on a weighted Euclidean distance measure and clustering paradigm to capture and identify the difference between normal miRNA expression and cancerous miRNA expression patterns, available from prostate, colon, lung and uterine miRNA expressions.

S.S. Ray, J. Pal and S.K. Pal

Swarm Intelligence

Semi-supervised classification methods make use of the large amount of relatively inexpensive available unlabeled data along with the small amount of labeled data to improve the accuracy of classification. A novel semi-supervised classification method based on the property of aggregation pheromone found in natural behavior of real ants is proposed. The proposed aggregation pheromone density based semi-supervised classification algorithm is `self-training' in nature where the classifier is first trained with a small amount of labeled data. Then the classifier is used to classify the unlabeled data. After that high confident unlabeled patterns, together with their predicted labels, are added to the training set. The classifier is (re)trained and the procedure is repeated until convergence. In this way, the classification accuracy is improved. The proposed algorithm is evaluated with a number of synthetic as well as real life benchmark data sets in terms of classification accuracy, macro averaged F1 measure, and micro averaged F1 measure. Results are compared with two conventional supervised classification methods and two recent semi-supervised classification techniques. Experimental results show the potentiality of the proposed algorithm.

The proposed semi-supervised classification algorithm is applied for multiple change detection in remotely sensed images. Two automatic unsupervised methods for generating initial training pattern (required for the semi-supervised classification) are adopted. One method is based on two-phase K-means clustering approach to identify the unchanged and different kinds of changed pixels. Here, the number of changes is also determined automatically using cluster validity criteria. In the second kind of unsupervised approach we adopted automatic thresholding technique for generating initial training patterns. Experimental results show the potentiality of the proposed method for multiple change detection.

A. Halder and A. Ghosh

A novel condensed polynomial neural network is designed using particle swarm optimization (PSO) technique for classification. In solving classification task, classical algorithms such as polynomial neural network (PNN) and its variants need more computational time as the partial descriptions (PDs) grow over training period layer-by-layer and make the network complex. Unlike PNN the proposed network needs to generate the partial description for a single layer. Discrete PSO (DPSO) is used to select a relevant set of PDs as well as features with a hope to get better accuracy. The weights associated with the links from hidden to output neuron is optimized by PSO for continuous domain (CPSO). Performance of this model is compared with the results obtained from PNN. Simulation result shows that the performance of this model both in processing time and accuracy is encouraging for harnessing its power in domain with large and complex data, particularly in data mining area.

A. Ghosh

Social Network Analysis

Large scale on-line social networks became popular in recent years. Twitter, Facebook, Orkut, LinkedIn are a few examples. These social networks have millions of users. People around the globe are connected with the purpose of common interests. These applications are becoming a huge marketing platform of products and services, specially spreading the information to a large number of people in a short amount of time. However, the most important question arises “How to select the influential individual quickly, to target for marketing?” On-line social networks are dynamic in nature with large amount of user base. The most challenging part of the work is to deal with the large scale data and network dynamics. Solution needs to be flexible and efficient. In our research we have proposed a centrality measure based on independent cascade model of diffusion and rank the nodes of social network accordingly. This solution to the k-top Influence Maximization problem shows significant improvement over the available solutions.

S. Kundu, C.A. Murthy and S.K. Pal

Cognitive Vision

Work is in progress towards developing a model of the non-linear interaction of the classical visual receptive field (CRF) and the extra-classical receptive field (ECRF), comprising of non-linear mean increasing and decreasing sub-units. It has been shown that the Laplacian kernel is in fact only a special case, where the ECRF actually reduces to the CRF. In contrast to the Laplacian mask, which yields a binary edge map after suitable thresholding, the proposed mask directly produces upon convolution with any grayscale image a binary output that amounts to an overall figure-ground segregation of the visual scene. This is the main advantage of the proposed ECRF based spatial filter. Moreover, apart from such bi-segment output, this algorithm, it has been demonstrated, may also be applied to carry out multi-segmentation of the visual scene. The main advantage of the proposed algorithm in carrying out segmentation lies in its simplicity.

K. Ghosh

Fuzzy Sets, Rough Sets and Logic

Theory of graded consequence is a topic within the broad area of fuzzy logic. The theory was introduced by Chakraborty in 1986. It proposes to assign a degree of derivability to a derivation

process and to consistency. Axioms of the notion of graded consequence were already laid down. In the recent works necessary and sufficient conditions for satisfiability of two of the axioms in particular have been studied and examples are provided. Proof theory like results in this context is investigated.

M. K. Chakraborty and S. Dutta

Rough Set theory based on covering of a set instead of a partition as is usually done has been investigated in detail with the definitions of various types of lower and upper approximations of a subset of objects in a universe. A comparison is carried out. Corresponding implication lattices are investigated and approximate reasoning methods with rough modus ponens rules have been suggested.

P. Samanta and M. K.Chakraborty

Para-Consistent Logic is an area of research that originated in Brazil and Australia and is now widely studied worldwide. Our work deals with the axiomatization of Para Consistency criteria. It is observed that unlike classical logic, in paraconsistent logics the notion of consistency is local that is, a set may be inconsistent with respect to some statements and consistent with respect to another. A comparison among various paraconsistent logics from the angle of the behavior of negation has been carried out.

S. Dutta and M. K. Chakraborty

Computer and Statistical Services Centre

CSSC manages the central computing facilities of ISI, Kolkata. It serves approximately 700 users. Software packages available at the centreare – Oracle, Arc GIS, BMDP, Mathematica, SAS, SHAZAM, S-Plus and TSP.The centre manages campus - wide network and internet facilities atISI, Kolkata, in consultation with the Committee for Extension andMonitoring of Campus Network and Internet Services.The center also manages the inventory of computers in consultationwith the Computer Purchase Committee.The centre provides statistical and numerical consultancy services to scientists and research scholars, including non-ISI scientists. The centre occasionally conducts workshop for training ISI officials on using of computers. The centre organizes courses for North-eastern states of India. Members of CSSC take part in teaching different courses of the institute. Members of CSSC supervise project work of non-ISI students studying MCA, B-Tech, etc.

3. PROJECTS

Internally Funded Projects

Ongoing Projects

Sl. no.	Name of the project	Principal Investigator(s)	Unit(s) involved
Applied Statistics Division			
1.	Understanding Genomics and Organ Specific Fractals Landscapes in Transplantable Organs	Pabitra Pal Choudhury	ASU
2.	Cylindrical Regression with Categorical and Count Data	Ashis SenGupta	ASU
3.	Bayesian Modelling and Inference for Directional Data	Sourabh Bhattacharya	BIRU
4.	Application of Mahalanobis Taguchi Strategy in Pattern Recognition	Rita Saha Ray	BIRU
5.	Application of Statistical Methodologies in Content Based Image Retrieval	Smarajit Bose	BIRU
6.	Analysis of Olfactory Receptor Genomic Clusters at the Functional level using Boolean Function/Cellular Automata and Pattern Recognition Techniques	Amita Pal	BIRU
Computer and Communication Sciences Division			
1.	Power and Bandwidth Management in Wireless Networks	Bhabani P. Sinha	ACMU
2.	Computer-aided Design and Testing of Digital Microflidic Nano-Biochips	Bhargab B. Bhattacharya	ACMU
3.	Nano-CAD and Cluster Computing Labs	Bhargab B. Bhattacharya and Susmita Sur-Kolay	ACMU
4.	Low Memory Algorithms	Arijit Bishnu	ACMU
5.	Energy-efficient Routing in Mobile Ad-hoc Networks	Nabanita Das	ACMU
6.	Design of Automatic bangle Spellchecker	B.B. Chaudhuri	CVPR
7.	Analysis of Individual Handwriting	B.B. Chaudhuri	CVPR
8.	Sub-Document-Level Information Retrieval	M. Mitra	CVPR
9.	Machine Authentication of Printed security Document	U. Garain	CVPR
10.	Automatic reading of Texts in Camera Captured Images	U. Bhattacharya	CVPR
11.	Multi-Script Document Recognition	U. Pal	CVPR
12.	Studying Architectural Distortion in Mammogram	D.P. Mukherjee	ECSU
13.	Studying on Temporal Variation of Aerosol in Relation with Variation of Boundary Layer at Giridih (Indo Gangetic Plain)	A.K. De	ECSU

14.	Protein Fold Prediction using Short Structural Motifs (Building Blocks)	N.R. Pal	ECSU
15.	Prediction of Radiation Fog using DNA Computing	K.S. Roy	ECSU
16.	Use of computational intelligence approach for image and video data security and retrieval based on biometric signatures	M.K. Kundu	MIU
17.	Face recognition in color images II	C.A. Murthy	MIU
18.	Incorporation of knowledge for analyzing biological data	S. Mitra	MIU
19.	An integrated approach to rational drug design	S. Bandyopadhyay	MIU
20.	Development of pattern recognition and machine learning tools for solving certain problems in systems biology -II	R.K. De	MIU
21.	Development of Gene Selection Algorithms from Microarray Data: Fuzzy-Rough and Neighborhood Rough Set Based Approaches	P. Maji	MIU
22.	A study on application of semi-supervised clustering for analysis of remote sensing images and microarray data.	B. Uma Shankar	MIU
23.	Derivation of spatially significant set via spatial analysis and reasoning	B.S. Daya Sagar	SSIU
Physics and Earth Sciences Division			
1.	Floodplain facies: A study of litho-facies and geochemistry of the fines-dominated fluvial deposits of the Gondwana successions	P. Ghosh	GSU
2.	A systematic study of marine gastropod assemblages from the Jurassic rocks of Kutch, western India with special emphasis on faunal endemism	S.S. Das	GSU
3.	Morphology, function and ecology of the Mesozoic non-marine tetrapods of the Gondwana basins of peninsular India	D.P. Sengupta	GSU
4.	Experimental investigations on the genesis of obstacle marks and their implications for the generation of current crescents	B.S. Mazumder	PAMU
Biological Sciences Division			
1.	Introducing Tropical Sugar Beet `TSB` (*Beta vulgaris* L.) in West Bengal: A Study on Yield Performance.	S. Barik	AERU
2.	Nanobiotechnology: Applications in Agriculture and Veterinary Sciences.	A. Goswami	AERU
3.	Integrated Nutrient Management for Sisal cultivation in laterite soil of Girdih, a Sub-Tropical Plateau Region of India	M. Ghose	AERU & Stat-Math Unit

4.	Mycorrhizal status of Mangroves of the Sundarbans	M. Ghose	AERU
5.	Monitoring of pond biodiversity to assess the ecological status of ponds	A. Dewanji	AERU & ASU
6.	Development of new Agrochemicals from plant allelochemicals and their possible implication in Agricultural practices.	S. Mandal Biswas	AERU
7.	Determination of functional response under selective predation through experimentation and modeling.	J. Chattopadhyay	AERU
8.	Chemical and Microbiological Studies on Haritaki (*Terminalia chebula* Retz.) against Uropathogenic *Escherichia coli*	R. R. Chattopadhyay	AERU
9.	Management strategies for rice cultivation in the eastern plateau: Ethnoscientific, field experimental and crop modelling approaches.	P. Banik & J Chattopadhyay	AERU
10.	A Molecular genetic study of couples with recurrent spontaneous abortions	B.M. Reddy	BAU
11.	Diet, Activity and Aging: A Prospective Study among the Elderly of Kolkata	B. Mukhopadhyay	BAU
12.	Weight related behaviours among adolescent girls: An exploratory study	S. Mukhopadhyay	BAU
13.	Involvement of cervical cancer stem cells and cell-cycle regulatory proteins of INK4 and CIP/KIP in the pathogenesis of HPV 16 related cervical cancer	S. Sengupta	HGU
14.	Multi-locus association and related issues	I. Mukhopadhyay	HGU
Social Sciences Division			
1.	Generation of Differentiated Electronic Lexicon for Bangla	Probal Dasgupta	LRU
2.	Interlexical Study of Assamese and Boro Nominal Items	Probal Dasgupta	LRU
3.	Labor Productivity in the Indian Steel industry: A Study of the Rail and Structural Mill of the SAIL Plant in Bhilai	E.Somanathan & Rohini Somanathan (Delhi School of Economics)	Planning Unit
4.	Sectoral Policies and Sectoral reallocation in the Growth Process	Chetan Ghate & Gerhard Glomm (Indiana University)	Planning Unit
5.	Adult Literacy, Human Capital Accumulation, and Economic Growth	Chetan Ghate & Gerhard Glomm (Indiana University)	Planning Unit
6.	Optimal Compensation with Team Work: An Experimental Investigation	Priyodorshi Banerjee	Planning Unit
7.	Long-run Impact of Displacement on Income and other Component of Well-being	E. Somanathan & Rohini Somanathan (Delhi School of Economics)	Planning Unit

8.	The Economic Causes of Crop Residue Burning in the Rice-Wheat System of the Indo-Gangetic Plain	Ridhima Gupta & E. Somanathan	Planning Unit
9.	Political Opportunism and Economic Performance in Major Indian Statesd, 1967-2007	Bhaskar Dutta, Sugato Dasgupta (JNU) & E. Sridharan (University of Pennsylvania)	Planning Unit
10.	Finding a Tracking Identifier for Poverty	Abhiroop Mukhopadhya & Indira Rajaraman	Planning Unit
11.	Competition Dynamics and Sustainability of Micro Finance Institutions	Prabal Roy Chowdhury & Indrani Roy Chowdhury (Jamia Milia Islamia University)	Planning Unit
12.	Productivity Growth in Indian Manufacturing: What does Plant level data reveal	Suresh Babu (IIT, Chennai and ISEC, Bangalore), Pulapre Balkrishnan(JNU), Bharat Ramaswami and Abhiroop Mukhopadhyay	Planning Unit
13.	Empirical Testing of Iterative Multi-Object Auctions	Debasis Mishra	Planning Unit
14.	Does Gender Impact Public Accountability and the Quality of Poverty Alleviation Programmes - Evidence from Andhra Pradesh	Vegard Iversen, Farzana Afridi (Delhi School of Economics)	Planning Unit
15.	Understanding Deforestation in North-East India	E.Somanathan	Planning Unit
16.	Self-efficacy of agricultural farmers	D. Dutta Roy	Psychology Research Unit, SRU & AGU
17.	Evaluation of child labour welfare programmes through the study of child labour schools in North 24 Parganas, West Bengal	Aniruddha Chakravarty	SRU
Statistical Quality Control and Operations Research Division			
1.	Survey on status of application of Six Sigma methodology in manufacturing and service industries	S.S Handa & S.M. Subhani	SQC & OR, Delhi & Hyderabad
Library, Documentation and Information Sciences Division			
1.	Processing of documents from the personal collection of P.C. Mahalanobis	Krishna Bhattacharya	PCM Museum & Archive, Kolkata
2.	Reclassification of selected areas of Library Collections	Shikha Bhowmick	Library, Kolkata

Completed Projects

Sl. No.	Name of the project	Principal Investigator(s)	Unit(s) involved
Theoretical Statistics and Mathematics Division			
1.	Young Visitors Program	Mrinal Kanti Das	Stat-Math Unit, Kolkata
2.	Growth Curve Estimation	Ratan Dasgupta	Stat-Math Unit, Kolkata
Computer and Communication Sciences Division			
1.	Moving Gourds in Polygonal Environment	Sandip Das	ACMU
2.	Geometric Covering Problems	Subhas C. Nandy	ACMU
3.	Techniques for Robust Physical Design of Nanometer ICs	Susmita Sur-Kolay	ACMU
4.	Development and application of an Ontology for Social Sciences with emphasis to Economics	M. Krishnamurthy	DRTC
5.	Soft Computing approach to watermarking and Semantic based retrieval of image and video frames. (Phase-II)	M. K. Kundu	MIU
6.	Evolutionary computation and data mining	C. A. Murthy	MIU
7.	Face Recognition in color images	C. A. Murthy	MIU
8.	Soft Data Mining for Analysis of Gene Expressions	S. Mitra	MIU
9.	Rough-Fuzzy Hybridization for Clustering Large Biological Databases	P. Maji	MIU
10.	Rough sets and Granular Computing to Image Processing Applications	B. Uma Shankar	MIU
Physics and Earth Sciences Division			
1.	Depositional systems and sequence stratigraphy of the Vindhyan inlier of the Hosangabad-Bhopal area	C. Chakraborty	GSU
2.	Sediment transportation and sorting processes in sand-pebble mixture in experimental channel and their geological implications	R. Mazumder	GSU
3.	Growth and evolution of Meso-Neoproterozoic carbonate platforms in the Chattisgarh and Cuddapah basins, south India: Tectonic and palaeogeographic implications	S. Patranabis-Deb	GSU
4.	Geochronological constraints on tectonic assembly and dispersion, in relation to the Eastern Ghats Orogen	S. Bhattacharya	GSU
5.	Physicochemical studies on organized assemblies of mixed surfactants	B.K. Paul	GSU
Biological Sciences Division			
1.	Studies on expression status of micro RNAs and their significance in the pathogenesis of oral and cervical cancer	B. Roy	HGU

Social Sciences Division			
1.	Equilibrium Play and Learning in the Decentralized Voluntary Provision of Public Goods	Priyodorshi Banerjee	Planning Unit
2.	Measuring the Burden of Cancer on Households	Abhiroop Mukhopadhyay	Planning Unit
3.	Emotional Display Rules and Personality Pattern Across Different Groups of Individuals.	Anjali Ghosh	Psychology Research Unit
4.	Bullying in School and its effect on behavioral aspects of School Students	Rumki Gupta	Psychology Research Unit
Statistical Quality Control and Operations Research Division			
1.	Status of Application of Six Sigma in Organisations (Manufacturing & Service) - Benefits & Drawbacks	S.S. Handa	SQC & OR Unit, Delhi
2.	Development of Classification Scheme for Sliver Defects of Interstitial-free Steel towards Optimization of the Steel Processing System	Prasun Das	SQC & OR, Kolkata
Library, Documentation and Information Sciences Division			
1.	Restoration and Digitization of photo Archives of ISI	Nibedita Ganguly	Library, Kolkata
2.	Standardization of Subject term/keywords in Catalogue of ISI Library, Kolkata	Sutapa Saha	Library, Kolkata
3.	Digital Repository of Contribution of ISI Scientist	Ashis Kumar Pal	Library, Kolkata
4.	Growth and Development of ISI Library: 1931-2009	Aloka Sarkar	Library, Kolkata

Externally Funded Projects

Ongoing Projects

Sl. no.	Name of the project	Principal Investigator(s)	Unit(s) involved	Funded by
Theoretical Statistics and Mathematics Division				
1.	Non Commutative Geometry groups and non-Commutative probability	Debashish Goswami	Stat-Math Unit, Kolkata	Dept. of Science & Technology (DST), Govt. of India
2.	Atiyah-Singer Index theorem and Gauge-theoretic Physics	Amiya Mukherjee	Stat-Math Unit, Kolkata	DST
3.	J.C. Bose Fellowship	Arup Bose	Stat. Math. Unit, Kolkata	DST
4.	Harmonic Analysis on Riemannian Symmetric spaces Damek-Ricci spaces Homogenous Tress	Rudra P. Sarkar	Stat-Math Unit, Kolkata	NBHM
5.	Safety monitoring capabilities of	Antar Bandyopadhyay		Air Traffic Management, Airport

	Indian airspace	and Deepayan Sarkar	Stat-Math Unit, Delhi	Authority of India, Ministry of Civil Aviation
6.	Interacting Particle Systems: Scaling Limits and Long Term properties	Siva Athreya	Stat-Math Unit, Bangalore	CSIR
7.	Algebraic codes associated with rank 2 residues of spherical buildings	N.S.N. Sastry	Stat-Math Unit, Bangalore	DST
Applied Statistics Division				
1.	Robust implementation of a Variant of the Rajndael (AES)	Palash Sarkar	ASU	WESEE, Ministry of Defence
2.	Analysis of Cryptographic Algorithms & Evaluation on Enhancing Network Security Based on Mathematical Science	Bimal Roy	ASU	DST
3.	Design and Development of Database and Analytical Tools for Microarray Data on *Leishmania donovani* Parasite	Ashis SenGupta	ASU	Ministry of Science & Technology, Govt. of India
4.	Language and Brain Organization in Normative Multilingualism	Sumitra Purkayastha	BIRU	DST
Computer and Communication Sciences Division				
1.	New Techniques of Fast Image Compression Based on Human Vision Systems and Geometric Data Structures	B.B. Bhattacharya and M.K. Kundu	ACMU MIU	Intel Corporation, USA
2.	Delay Fault Modeling and Test Generation for Power Supply Noise	S. Sur-Kolay and B.B. Bhattacharya	ACMU	Intel Corporation, USA
3.	Distributed Algorithms for Geometric Problems on Robot Swarms	Krishnendu Mukhopadhyaya	ACMU	DST, Govt. of India
4.	Development of Robust Document Analysis and Recognition Systems-Phase II	B.B. Chaudhuri	CVPR	Dept. of Information Technology (DIT), Govt. of India
5.	Cross-Lingual Information Access System (CLIA) – Phase II	M. Mitra	CVPR	DIT
6.	Development of Online Handwriting Recognition System for Indian Languages	S.K. Parui	CVPR	DIT
7.	Development of Dependency Parser for Bangla Computer Based Translation Teaching	U. Garain	CVPR	SNLTR
8.	Living Knowledge	A.R.D. Prasad & Devika P. Madalli	DRTC	European Union Commission
9.	To predict the Meteorological Images from given sequences of Images.	B. Chanda	ECSU	Indian Space Research Organisation (ISRO).

10.	Digital Image reconstruction of Indian Cultural heritage with Focus on Hampi Ruins	B. Chanda	ECSU	DST
11.	Processing and Analysis of Aircraft Images with Machine Learning Techniques for Locating Objects of Interest	A. Ghosh	MIU	US Army
12.	Computational Methods for MicroRNA Target Detection and Its Role in Cancer Development	S. Bandyopadhyay	MIU	DST
13.	Development of Efficient Many objective Optimization Technique with Parallel Computing and Objective Reduction	S. Bandyopadhyay	MIU	DST & Consejo Nacional de Ciencia y Tecnologia (CONACYT), Mexico
14.	Distributed Knowledge Discovery in Ad Hoc and Sensor Networks for Event Monitoring	S. Bandyopadhyay	MIU	DST
15.	Computation in the brain: neuron, synapse, astrocyte	Kaushik K. Majumdar	SSIU	DST
Physics and Earth Sciences Division				
1.	Stratigraphic analysis of the Chattisgarh succession: Implications on Meso-to-Early Neoproterozoic lithospheric dyamics	Sarbani Patranabis Deb	GSU	DST
2.	Sedimentation history of Paleoproterozoic Dhalbhum and Dalma Formations in the Kokpara-Tata sector, eastern India and its implications	R. Mazumder	GSU	DST
3.	Thermal evolution of Penninsular India	S. Bhattacharya	GSU	DST
4.	Nellore schist belt and Proterozoic tectonics of southeastern margin of India	D. Saha	GSU	DST
5.	Ganga River Basin Management Plan	T. Chakraborty	GSU	Ministry of Environment & Forests, Govt. of India
6.	Influence of bedforms on turbulent characteristics and its implications to sedimentology: An experimental study	B.S. Mazumder	PAMU	DST
7.	Particle-fluid interactions at turbulent boundary layer flow over smooth/rough surface using Image processing technique	B. S. Mazumder	PAMU	Council of Scientific and Industrial Research (CSIR)
8.	Digital imaging technique for investigations of particle-fluid interactions due to turbulent flow	Anindita Bhattacharya	PAMU	DST
9.	NASI senior scientist platinum jubilee fellowship	B. N. Mandal	PAMU	National Academy of Sciences India (NASI)

Biological Sciences Division				
1.	Development of information on agricultural and horticultural production and their marketing using RS and GIS in some districts of West Bengal	P. Banik	AERU	DST, West Bengal
2.	Studies on Environmental and Ecological Aspects of Mangrove Biology	M. Ghose	AERU	University of Western Sydney, Australia
3.	Development of Agro-Entomotoxic nanoparticles and their use in medical Science: Applied and Basic Aspects	A. Goswami	AERU	AERU
4.	Designing, and studying mode of action and biosafety of nanopesticides	A. Goswami	AERU	AERU
5.	Process for the protein-assisted nanocomposite synthesis of silica-protease/chitinase acid (Si-protease/chitinase-HAs) as bioencapsulated pesticides	A. Goswami (Co-PI)	AERU	AERU
6.	Eco-epidemiological modeling on disease dynamics with disease on both prey and predator population.	J. Chattopadhyay	AERU	AERU
7.	Physical Growth, Body Composition and Nutritional Status of the Bengali School aged children, Adolescents and Young adults of Calcutta, India. Effects of Socioeconomic factors on secular trends.	P. Dasgupta	BAU	The NHF, The Netherlands
8.	Statistical Methods For Mapping Multivariate Phenotypes	S. Ghosh	HGU	Fogarty International Center, NIH
9.	Studies on expression and analysis of miRNA genes in oral cavity cancer and precancer: Significance in marker development and pathogenesis	B. Roy	HGU	Department of Biotechnology, Govt. of India
10.	Host-virus interactions at the genetic and epigenetic levels in HPV related cervical cancer in Indian women	S. Sengupta	HGU	Department of Biotechnology, Govt. of India
11.	Statistics in Genetic Medicine: Developing Methods for Quantitative Trait Locus Mapping and Estimating Genotype-Environment Interactions	S. Ghosh	HGU	ICMR
Social Sciences Division				
1.	Impact of Economic Reforms on Tribal Poverty	Kunal Chattopadhyay	ERU	NABARD
2.	Development of Methodology Towards Measurement of Poverty	Manoranjan Pal	ERU	Ministry of Statistics and Programme Implementation (MOSPI), GoI

3.	Socio-Economic Conditions of Five Minority Communities in the District of Murshidabad ,West Bengal	Pulakesh Maiti	ERU	Government of West Bengal
4.	Language & Brain Organization In Normative Multilingualism	Probal Dasgupta	LRU	DST
5.	Indian Language Corpora Initiative-Bengali	Niladri Sekhar Dash	LRU	DIT
6.	Indradhanush Wordnet Development for Bengali Language	Probal Dasgupta & Niladri Sekhar Dash	LRU	DIT
5.	Economic Mechanisms to Create and Preserve Habitat Connectivity in the Western Ghats of India	E. Somanathan	Planning Unit	The University of Melbourne, Australia
6.	Estimation of Technical Manpower Requirement in West Bengal	Prasanta Pathak	PSU	West Bengal State Council of Technical Education
Statistical Quality Control and Operations Research Division				
1.	Six Sigma Green Belt Program	E.V. Gijo	SQC & OR Unit, Bangalore	ITC
2.	Six Sigma Training & Implementation	A .R. Chowdhury, U.H. Acharya, Somnath Ray & E.V. Gijo	SQC & OR Unit, Bangalore	Bosch
3.	Six Sigma Training & Implementation	A.R. Chowdhury Somnath Ray	SQC & OR Unit, Bangalore	Tata BP Solar
4.	Development of Statistical Process Performance Models	Boby John	SQC & OR Unit, Bangalore	HP Global Soft
5.	Six Sigma Training	Boby John	SQC & OR Unit, Bangalore	Accenture
6.	Six Sigma Implementation	A.R. Chowdhury U.H. Acharya Somnath Ray Sanjit Ray E.V. Gijo	SQC & OR Unit, Bangalore	Qualmind Global
7.	Continuous Improvement Projects	Sanjit Ray	SQC & OR Unit, Bangalore	JK Tyre, Mysore
8.	Six Sigma Training & Implementation	U.H. Acharya K.K. Chowdhury A.R. Chowdhury Somnath Ray E.V. Gijo	SQC & OR Unit, Bangalore	TVS Motor Company
9.	Consultancy Services, Continual Improvement, System Implementation	A.Rajagopal	SQC & OR Unit, Coimbatore	Durairaj Mills
10.	Six Sigma Training and Project Consultancy	A.Rajagopal	SQC & OR Unit, Coimbatore	CTS

11.	Training on Statistical Technique for industry cluster (SME)	A.Rajagopal	SQC & OR Unit, Coimbatore	Apex Cluster
12.	Consultancy Services, Continual Improvement, System Implementation	A.Rajagopal	SQC & OR Unit, Coimbatore	MYK
13.	Six Sigma Training and Project Consultancy	A.Rajagopal	SQC & OR Unit, Coimbatore	KG Hospital
14.	Consultancy Services, Continual Improvement, System Implementation	A.Rajagopal	SQC & OR Unit, Coimbatore	TCTP
15.	Consultancy Services, Continual Improvement, System Implementation	A.Rajagopal	SQC & OR Unit, Coimbatore	SRC
16.	Consultancy Services, Continual Improvement, System Implementation	A.Rajagopal	SQC & OR Unit, Coimbatore	Bannari Amman Spinning Mills
17.	Consultancy Services, Continual Improvement, System Implementation	A.Rajagopal	SQC & OR Unit, Coimbatore	FCRI
18.	Six Sigma Training and Project Consultancy	A.Rajagopal	SQC & OR Unit, Coimbatore	GHCL Limited
19.	Six Sigma Training and Project Guidance	A.Rajagopal	SQC & OR Unit, Coimbatore	Office Six Sigma
20.	5 Six Sigma Projects	Rina Chakravorty	SQC & OR Unit, Delhi	Artemis Medicare Services Ltd, Gurgaon
21.	Modeling to forecast the demand and price of electricity in deregulated market of India	Amitava Bandyopadhayay	SQC & OR Unit, Kolkata	CERC
22.	Reviewing the computation methodology for escalation rate	Amitava Bandyopadhayay	SQC & OR Unit, Kolkata	CERC
23.	Data Quality Management	S.K. Majumdar	SQC & OR Unit, Kolkata	Petroleum Planning & Analysis Cell (PPAC), Ministry of Petroleum and Natural Gas,
Center for Soft Computing Research				
1.	Statistical, Structural and Soft Computing based Techniques for Pattern Recognition: Theory, Algorithms and Applications to Bioinformatics	S.K. Pal	Center for Soft Computing Research	Indo-Brazil collaborative project, DST, New Delhi

Completed Projects

Sl. no.	Name of the project	Principal Investigator(s)	Unit(s) involved	Funded by
Applied Statistics Division				
1.	Universal one-way Hash Family (UOWHF)	Bimal Roy	ASU	WESEE, Ministry of Defence

2.	Research and Development of some Cryptographic Primitives	Bimal Roy	ASU	Ministry of Information Technology
3.	Exploratory Paradigms in Visual Cryptography	Bimal Roy	ASU	WESEE, Ministry of Defence
Computer and Communication Sciences Division				
1.	Advanced Techniques for Remote Sensing Image Processing - Phase II	A. Ghosh	MIU	DST & University of Trento
Physics and Earth Sciences Division				
1.	Mesozoic Gondwana Vertebrates from Madhya Pradesh, India: an integrated Study on paleobiology.	Saswati Bandyopadhyay (Co PI)	GSU	DST
2.	Image processing technique to study the particle behavior in the near wall region of turbulent open channel flow	B.S. Mazumder	PAMU	CSIR
Social Sciences Division				
1.	Final (External) Evaluation of Special adult Literacy Programme at Tripura	Anjali Ghosh	Psychology Research Unit	Government of Tripura
Statistical Quality Control and Operations Research Division				
1.	Six Sigma Green Belt Program	U.H. Acharya K.K. Chowdhury A.R. Chowdhury Somnath Ray E.V. Gijo	SQC & OR Unit, Bangalore	NADP
2.	Measurement System Analysis	U.H. Acharya	SQC & OR Unit, Bangalore	AT & S
3.	Statistical Techniques for MIS Professionals	Boby John	SQC & OR Unit, Bangalore	Hinduja Global Solutions
4.	Statistical Techniques for Business Analytics	Boby John	SQC & OR Unit, Bangalore	Microsoft India
5.	Program on Statistical Methods	E.V. Gijo	SQC & OR Unit, Bangalore	Allianz Cornhill Information Services
6.	FMEA	U.H. Acharya	SQC & OR Unit, Bangalore	Beceem Communications
7.	Applications of Design of Experiments in Chip Design	Boby John	SQC & OR Unit, Bangalore	Beceem Communications
8.	Statistical Techniques for Quantitative Project Management	Boby John	SQC & OR Unit, Bangalore	Beceem Communications
9.	Six Sigma Green Belt Program	Boby John U.H. Acharya I. Islam	SQC & OR Unit, Bangalore	Bharat Electronics

10.	Six Sigma Black Belt Program	Somnath Ray Boby John Sanjit Ray	SQC & OR Unit, Bangalore	Hewlett Packard
11.	Six Sigma Green Belt Program	Boby John	SQC & OR Unit, Bangalore	Accenture
12.	Six Sigma Champion Program	A.R. Chowdhury U.H. Acharya Somnath Ray	SQC & OR Unit, Bangalore	Bosch
13.	Training Program on Six Sigma Black Belt Certification	D. Sampangi Raman	SQC & OR Unit, Chennai	Apollo Hospitals Enterprise Limited, Chennai
14.	Training Program on Effectiveness of Antiseptic Coated	D. Sampangi Raman	SQC & OR Unit, Chennai	D.J. Reddy Heart Surgery Associates, Chennai
15.	Vendor Development	D. Sampangi Raman	SQC & OR Unit, Chennai	ITC Limited, Chennai
16.	Statistics with Minitab	G. Ravindran & D. Sampangi Raman	SQC & OR Unit, Chennai	Sundaram Fasteners Limited, Virudhunagar
17.	Green Belt Certification	D. Sampangi Raman	SQC & OR Unit, Chennai	National Institution for Quality & Reliability
18.	Design of Experiments	G. Ravindran	SQC & OR Unit, Chennai	Ashok Leyland Limited, Chennai
19.	Advanced Statistical Techniques	G. Ravindran, D. Sampangi Raman & Surajit Pal	SQC & OR Unit, Chennai	Verizon Data Services India Pvt. Ltd., Chennai & Hyderabad
20.	Seven QC Tools	D. Sampangi Raman & Surajit Pal	SQC & OR Unit, Chennai	Elsevier Publishing Services, Chennai
21.	Statistical Process Control	G. Ravindran & Amit K. Biswas	SQC & OR Unit, Chennai	Bosch Electrical Drives India Pvt. Ltd, Chennai
22.	Market Contribution per one kg of Yarn and net worth of the company and improving Surveillance System	A. Rajagopal	SQC & OR Unit, Coimbatore	Bannari Amman Spinning Mills Ltd, Dindigul
23.	Reducing Lot to Lot variation in yarn Quality	A. Rajagopal	SQC & OR Unit, Coimbatore	Durai Raj Mills Ltd, Pasur
24.	Study on Cost Control with Quality-Correlation of Water Consumption, firewood Consumption, Oil furnace, for Continual improvement	A. Rajagopal	SQC & OR Unit, Coimbatore	TCTP, Erode
25.	Study on Feed back Analysis by foreign trainees for Training Improvement	A. Rajagopal	SQC & OR Unit, Coimbatore	Fluid research Control Institute, Palakad
26.	Customer Satisfaction analysis for infrastructure review and revenue	A. Rajagopal	SQC & OR Unit, Coimbatore	SRC Projects, Palladam

27.	Reducing Count Variation in Yarn Quality	A. Rajagopal	SQC & OR Unit, Coimbatore	MYK Spinning Mills, Mahanagar
28.	Training and System Implementation	A. Rajagopal	SQC & OR Unit, Coimbatore	TCTP, Erode
29.	In Plant Training Programme on Six Sigma Green Belt and Black belt including Project Consultancy for Software's	A. Rajagopal	SQC & OR Unit, Coimbatore	Cognizant Technology Solutions, Coimbatore
30.	In Plant Training Programme on Six Sigma Green belt and Black belt including Project Consultancy for health Science	A. Rajagopal	SQC & OR Unit, Coimbatore	KG hospitals, Coimbatore
31.	General Training Programme on Six Sigma Green Belt and Black Belt including Project Guidance at Office	A. Rajagopal	SQC & OR Unit, Coimbatore	Participants
32.	Environmental study at TCTP	A. Rajagopal	SQC & OR Unit, Coimbatore	TCTP, Erode
33.	Quality & Process Improvement	G. Murali Rao	SQC & OR Unit, Hyderabad	Quislex Legal Services Pvt. Ltd.
34.	Development of statistical procedures for improving operations management of APCPDCL	G.S.R. Murthy & A.L.N. Murthy	SQC & OR Unit, Hyderabad	Central Power Distribution Corporation of AP (APCPDCL)
35.	Statistical Process Control	A.L.N. Murthy G. Murali Rao	SQC & OR Unit, Hyderabad	Solar Semiconductor
36.	FMECA	A.L.N. Murthy G. Murali Rao	SQC & OR Unit, Hyderabad	AGI glaspac
37.	Design of Experiments	S.M. Subhani	SQC & OR Unit, Hyderabad	Matrix Laboratories Ltd.
38.	ISO 9000/SQC techniques implementation	S.M. Subhani	SQC & OR Unit, Hyderabad	Kurnool Cylinders Pvt. Ltd.
39.	Tolerance estimation for Seed Germination	G. Murali Rao	SQC & OR Unit, Hyderabad	Seedsman Association of AP
40.	Six Sigma Implementation	A. Sarkar	SQC & OR Unit, Mumbai	Larsen & Toubro Ltd.
41.	Six Sigma Implementation	A. Sarkar	SQC & OR Unit, Mumbai	HDFC Standard Life Insurance
42.	Six Sigma Implementation	A. Sarkar	SQC & OR Unit, Mumbai	Enercon India Pvt. Ltd.
43.	Statistical Process Control Training at WELSPUN	A. Sarkar	SQC & OR Unit, Mumbai & Bangalore	Welspun Ltd. Gujarat
44.	Six Sigma Training at RIL BPO	A. Sarkar	SQC & OR Unit, Mumbai	Reliance BPO

45.	Reliability Programme at AMW, Bhuj	A. Sarkar	SQC & OR Unit, Mumbai	Asia Motor Works
46.	MBB Training	A. Sarkar	SQC & OR Unit, Mumbai	HDFC Bank
47.	Six Sigma GB Training	A. Sarkar	SQC & OR Unit, Mumbai	Tata Capital
48.	Statistical Process Control Training	A. Sarkar	SQC & OR Unit, Mumbai	Ultratech
49.	Six Sigma Green Belt Training	A. Sarkar	SQC & OR Unit, Mumbai	XIMB
50.	Development of Brand Trust Index	A. Sarkar	SQC & OR Unit, Mumbai	Blue Lotus
51.	Application of Design of Experiment in Nano-Particle project	S. Rath	SQC & OR Unit, Pune	ARAI, Pune
52.	Training, Project Guidance & consulting services of Six Sigma	S. Rath	SQC & OR Unit, Pune	ARAI, Pune

North East Projects

Ongoing Projects

Sl. no.	Name of the project	Principal Investigator(s)	Unit(s) involved
Physics and Earth Sciences Division			
1.	Thrust sequences, cross faults and fault zone rocks in the eastern Himalaya – Phase II	Dilip Saha	GSU
Biological Sciences Division			
1.	Genetic epidemiology of Malaria and prevalence of Hb E in northeast regions of the country	T.S. Vasulu	BAU

4. SYMPOSIA, CONFERENCES, WORKSHOPS, LECTURES AND SEMINARS ORGANISED

Symposia and Conferences

7th Annual Conference on "*Models and Methods in Economics*": Stat-Math Unit, Kolkata, February 02–03, 2011.

Satellite Conference on "*Functional Analysis and Operator Theory*": Stat-Math Unit, Bangalore, August 8–11, 2010.

ICM Satellite Meeting in "*Probability and Stochastic Processes*": Stat-Math Unit, Bangalore, August 13–17, 2010.

International Conference on "*Quantum Probability and Related Topics*": Stat-Math Unit, Bangalore, held at Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore, August 14–17, 2010.

International Conference on "*Buildings, Finite geometries and Groups*": Stat-Math Unit, Bangalore, August 29–31, 2010.

5th Meeting on Lectures on "*Probability and Stochastic Processes*": Stat-Math Unit, Bangalore, December 23-27, 2010.

Special Seminar on "*Reminiscence of Late Professor J. Roy founder of Applied Statistics Unit*": Applied Statistics Unit, Kolkata, March 31, 2011.

12th International Conference on "*Frontiers in Handwriting Recognition (ICFHR)*": Computer Vision and Pattern Recognition Unit, Kolkata, November 16-18, 2010.

7th Annual Conference on "*Models and Methods in Economics*": Economic Research Unit, Kolkata, February 02–03, 2011.

6th Annual Conference on "*Growth and Development*": Planning Unit, Delhi, December 16-18, 2010.

Conference on "*IGC-ISI Development Policy*": Planning Unit, Delhi, December 20-21, 2010.

International Congress on "*Productivity, Quality, Reliability, Optimization and Modelling (ICPQROM 2011)*": SQC & OR Unit, Delhi, with DRDO, QCI held at DRDO Bhawan and India Habitat Centre, New Delhi, February 7-8, 2011.

ISEC Diamond Jubilee Conference on "*Statistics, Economic Development and Public Administration*": SQC & OR Unit, Delhi, February 11-12, 2011.

Workshops and Training Programmes

Workshop on "*Probability and Stochastic*": Stat-Math Unit, Kolkata, January 06-07, 2011.

Workshop on "*Winter School on Functional Analysis*": Stat-Math Unit, New Delhi, December 6-22, 2010.

Nurture Programme on "*Mathematics Olympiad Camp*", Stat-Math Unit, New Delhi, July 1-16, 2010.

Advanced Instructional School in "*Representation Theory*": Stat-Math Unit, Bangalore, June 2–24, 2010.

Workshop on "*Data Analysis Using Statistical Packages"* (under North-East Training Programme): ASU, Kolkata, held at Manipur University, January 21-15, 2011.

Workshop on "*Data Analysis Using SPSS*" (under North-East Training Programme): ASU, Kolkata, held at BN College of Agriculture, Assam, March 23-25, 2011.

Workshop on "*Probability and Statistics"* (under North-East Programme): BIRU, Kolkata, held at Department of Statistics, Deb Raj Roy College, Golaghat, Assam, October 25-29, 2010.

Workshop on "*Small Area Estimation: Theory and Applications in Health Sciences"* (under North-East Programme): BIRU, Kolkata, held at Department of Statistics, Gauhati University, Guwahati, March 10-12, 2011.

Workshop on "*Applied Statistical Methods"*: BIRU, Kolkata, March 22, 2011.

Workshop on "*Nanocomputing and Biochips (Nano-Bio 2011)*": ACMU, Kolkata, March 1-2, 2011.

Workshop on "*Combinatorial Image Processing and Algorithms (WCIPA 2011)*": ACMU, Kolkata, March 3-4, 2011.

Workshop on "*Selected Topics in Algorithms*" (under North-East Programme): ACMU, Kolkata and Department of Computer Science & Engineering, Tezpur University, held at Tezpur University, Assam, March 21-23, 2011.

Workshop Session on "*Markov Models for Handwriting Recognition*" (Pre-Conference tutorial programme as a part of 12th ICFHR): CVPRU, Kolkata, November 15, 2010.

Winter School on "*Information Retrieval Systems and Experimentation*": CVPRU, Kolkata and SQC & OR Bangalore, held at ISI Bangalore, December 21–23, 2010.

Workshop on "*Intelligent Data Analysis: Theory and Applications*" (under North-East Programme): CVPRU, Kolkata held at Assam University, Silchar, March 1-5, 2011.

Workshop on "*Koha and NewGenlib"*: DRTC Unit, Bangalore, December 15-16, 2010.

Workshop on *"Advanced Dspace"*: DRTC Unit, Bangalore, February 17-18, 2011.

Workshop on "*Computational Information Processing*" (under North-East Programme): ECSU, Kolkata, held at Government Zirtiri Residential Science College, Aizawl, Mizoram, November 10-12, 2010.

Workshop on "*Regional Student Convention 2011*": ECSU, Kolkata with Computer Society of India, Kolkata Chapter, February 25, 2011.

Workshop on "*Computational Intelligence in Brain-Computer Interface and Context-Aware Service Management*": ECSU, Kolkata, March 17, 2011.

Workshop on "*Atmospheric Investigation and Related Issues*": ECSU, Kolkata, March 25, 2011.

Workshop on "*Support Vector Machine and Kernel Learning*": ECSU, Kolkata, March 22-23, 2011.

Winter School on "*Soft Computing*'' (under North East Programme): MIU, Kolkata, with Tezpur University, Assam held at Tezpur University, Assam, December 20-23, 2010.

Conferences and Seminars

Workshop on "*Honouring Prof. Jean Serra*": SSIU, Bangalore, October 26-27, 2010.

Workshop on "*Brain Science Awareness*": SSIU, Bangalore, March 14-15, 2011.

Four-Day Training Programme on "*Mathematical Morphology in Image Analysis, GISci, Geomorphology*": SSIU, Bangalore with ESIEE, University Paris-EST, France, October 19-22, 2010.

Three-day Workshops and Orientation Courses on "*Vertebrate Paleontology and Evolution*": GSU, Kolkata with Geological Survey of India held at GSI, Kolkata, November 30, 2010, February 10, 2011.

Workshop on "*Micro-Seminar on Nonlinear Phenomena*": PAMU, Kolkata, April 21, 2010.

Workshop on *"National Workshop on Modelling Biological Systems*" (under North-East Programme): PAMU, Kolkata with North Eastern Hill University, Shillong, held at NEHU, Shillong, October 25–29, 2010.

Workshop on "I*NDO-US Bilateral Workshop 2010*": PAMU, Kolkata with USA, November 1–3, 2010.

Workshop on "*Research and Data Analysis using IBM SPSS Statistics 18*": Biological Sciences Division, Kolkata with SPSS South East Asia and September 29-30, 2010.

Workshop on "*Economics-Physics Interface*": Economic Research Unit with Saha Institute of Nuclear Physics, Kolkata, November 19, 2010.

Workshop on "*Preserving Some Important Project Reports and The Historical Papers on the ISI in the ISI Archive and ISI Library*": Economic Research Unit with Library (P.C.M. Memorial Museum & Archives), Kolkata, March 3, 2011.

5th National Workshop on "*Indian Languages Corpora Initiative (ILCI)*": LRU, Kolkata with Department of Post Graduate Sanskrit, Utkal University, held at Utkal University, Bhubaneswar, February 21–23, 2011.

Four-week Training Program on "*Macro and Microeconomics*": Planning Unit, Delhi, April–May 2010.

Workshop on "*Estimation of Technical Manpower Requirement in West Bengal Through Effective Means for Improving Quality of Training of Technicians*": Population Studies Unit, Kolkata, October 8, 2010.

National Seminar on "*Dalit Households in Village Economies*": Sociological Research Unit, Kolkata, January 7-8, 2011.

Certification Program on "*Six Sigma Green Belt (GB-04)*": SQC & OR Unit, Bangalore, May 8-9 & May 14-16, 2010.

Certification Program on "*Six Sigma Black Belt (BB-08)*": SQC & OR Unit, Bangalore, July 5-10, 2010 (Phase-I) & September 13-18, 2010 (Phase-II).

Training Program on "*Data Mining & Business Analytics*": SQC & OR Unit, Bangalore, July 22–23, 2010.

Certification Program on "*Six Sigma Master Black Belt (MBB-14)*": SQC & OR Unit, Bangalore, September 20- October 1, 2010.

Certification Program on "*Six Sigma (with Lean) for IT / ITeS Industries*": SQC & OR Unit, September 6-11, 2010 (Phase-I) & November 8-13, 2010 (Phase-II).

Program on "*Data Mining & Business Analytics*": SQC & OR Unit, Bangalore, October 4–5, 2010.

Certification Program on "*Six Sigma Green Belt (GB-05)*": SQC & OR Unit, Bangalore, November 19-21 & November 27-28, 2010.

Program on "*Quantitative Project Management*": SQC & OR Unit, Bangalore, December 2–3, 2010.

Certification Program on "*Six Sigma Black Belt (BB-09)*": SQC & OR Unit, Bangalore, December 6-11, 2010 (Phase-I) & February 8-13, 2011 (Phase-II).

Annual Conference on "*Six Sigma along with Case Study Presentation Contest*": SQC & OR Unit, Bangalore, February 15-16, 2011.

Certification Program on "*Six Sigma Master Black Belt (MBB-15)*": SQC & OR Unit, Bangalore, February 28- March 11, 2011.

Certification Program on "*Six Sigma Green Belt* (for North-East Region)": SQC & OR Unit, Bangalore, held at Dibrugarh University, Dibrugarh, Assam, March 14–16, 2011.

Certification Program on "*Six Sigma Green Belt*": SQC & OR Unit, Bangalore, held at Shillong, Meghalaya, March 21–23, 2011.

Awareness Program on "*Six Sigma*": SQC & OR Unit, Bangalore, held at BVB College of Engineering and Technology, Hubli, Karnataka, March 24–25, 2011.

Training Program on "*Six Sigma Black Belt*": SQC & OR Unit, Chennai, April – December 2010.

Training Program on "*Six Sigma Green Belt*": SQC & OR Unit, Chennai, July 19-23, 2010.

Training Program on "*Six Sigma Green Belt*": SQC & OR Unit, Chennai, November 8-12, 2010.

Training Program on "*Statistics in Quality*": SQC & OR Unit, Coimbatore, held at CTS, Coimbatore, June 6, 2010.

Training Program on "*Control Valves and Actuators*": SQC & OR Unit, Coimbatore, held at FCRI, Palakad, December 8-10, 2010.

Training Program on "*Flow Metering in Gas Business* (for GAIL Engineers)": SQC & OR Unit, Coimbatore, held at FCRI, Palakad, December 13-17, 2010.

Three-day Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Delhi, April 21–23, 2010.

Three-day Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Delhi, July 14–16, 2010.

Training Programme on "*Six Sigma Black Belt*": SQC & OR Unit, Delhi, August 4–6 (1st Module), September 7–10 (2nd Module), October 26–29 (3rd Module), November 24–26, 2010 (4th Module).

Three-day Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Delhi, held at Accretive Health Services Pvt. Ltd., September 17–19, 2010.

Three-day Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Delhi, September 22–24, 2010.

Conferences and Seminars

Three-day Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Delhi, November 9–11, 2010.

Three-day Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Delhi, held at Artemis Medicare Services Ltd., December 6–8, 2010.

Three-day Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Delhi, January 12–14, 2011.

International Workshop on "*Six Sigma, Lean Philosophy & Taguchi Methods*": SQC & OR Unit, Delhi, February 4–5, 2011.

Training Programme on "*Six Sigma Master Black Belt*": SQC & OR Unit, Delhi, 14– 9 February (1st Module), 21–25 March 2011 (2nd Module).

Training Programme on "*Measurement of Uncertainty in Chemical and Biological Testing*": SQC & OR Unit, Delhi, with Central Pollution Control Board, New Delhi, February 2–25, 2011.

Training Program on *"Design of Experiments"*: SQC & OR Unit, Hyderabad, June 28-July 1, 2010.

Training Program on *"Problem Solving Techniques for Product & Process Improvement"*: SQC & OR Unit, Hyderabad, June 23-25, July 28-30, 2010, and February 9-11, 2011.

Training Program on "*Statistical Process Control*": SQC & OR Unit, Hyderabad, September 9, September16, and September 23, 2010.

Certification Program on "*Six Sigma Master Black Belt"*: SQC & OR Unit, Hyderabad, July-September, 2010.

Training Program on "*FMECA*": SQC & OR Unit, Hyderabad, September 17, 2010.

Certification Program on "*Six Sigma Green Belt*": SQC & OR Unit, Hyderabad, September 20-24, 2010.

Certification Program on "*Six Sigma Black Belt*": SQC & OR Unit, Hyderabad, November 29-December 4, 2010 (Phase-I) and January 17-22, 2011 (Phase-II).

Certificate Program on "*Six Sigma Green Belt"*: SQC & OR Unit, Hyderabad, February 14-18, 2011.

Workshop on "*Industry and Service Sectors using Computer Software*" (under North-East Programme): SQC & OR Unit, Kolkata, held at Dera Natung Govt. College, Itanagar, Arunachal, November 23-26, 2010.

One-day Workshop on "*Reliability*": SQC & OR Unit, Kolkata, February 9, 2011.

Certification Programme on "*Six Sigma Green Belt for TCL executives*": SQC & OR Unit, Mumbai, April 19-21, 2010 (2nd module).

Certification Programme on "*Six Sigma Master Black Belt*": SQC & OR Unit, Mumbai, April 26-30 (1st Module) and June 21-25, 2010 (2nd Module).

Training Programme on "*SPC with MINITAB for L&T executives*": SQC & OR Unit, Mumbai, May 5-6, 2010.

Training Programme on "*SPC for process industries for Ultratech cement executives*": SQC & OR Unit, Mumbai, May 24-26, 2010.

Training Programme on "*SPC with MINITAB for L&T executives*": SQC & OR Unit, Mumbai, June 3-4, 2010.
Certification Programme on "*Six Sigma Black Belt for L&T Executives*": SQC & OR Unit, Mumbai, June 7-11 (1st Module) and July 5-9, 2010 (2nd Module).

Training Programme on "*Reliability Engineering for Asia Motor Work's executives*": SQC & OR Unit, Mumbai, July 20-24, 2010.

Training Programme on "*SPC with MINITAB for L&T executives*": SQC & OR Unit, Mumbai, July 20-21, 2010.

Training Programme on "*SPC with MINITAB for L&T executives*"; SQC & OR Unit, Mumbai, July 22-23, 2010.

Certification Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Mumbai, July 26-30, July 2010.

Certification Programme on "*Six Sigma Master Black Belt for HDFC Bank Executives*": SQC & OR Unit, Mumbai, August 9-13 (1st Module) and August 30– September 3, 2010 (2nd Module).

Certification Programme on "*Six Sigma Black Belt*": SQC & OR Unit, Mumbai, August 24-27 (1st Module), September 20-23 (2nd Module), October 27-29 and November 24-26, 2010.

Training Programme on "*SPC for process industries for Welspun Industry executives*": SQC & OR Unit, Mumbai, September 27-29, 2010.

Certification Programme on "*Six Sigma Yellow Belt for ENERCON Executives*": SQC & OR Unit, Mumbai, October 1, 2010.

Training Programme on "*SPC with MINITAB for L&T executives*": SQC & OR Unit, Mumbai, October 11-13, 2010.

Certification Programme on "*Six Sigma Yellow Belt for ENERCON Executives*": SQC & OR Unit, Mumbai, October 20, 2010.

Certification Programme on "*Six Sigma Yellow Belt for ENERCON Executives*": SQC & OR Unit, Mumbai, October 21, 2010.

Certification Programme on "*Six Sigma Green Belt for ENERCON Executives*": SQC & OR Unit, Mumbai, October 26-27, November 19-20, 2010.

Training Programme on "*Statistical Process Control for Ordnance Factory*": SQC & OR Unit, Mumbai, November 19-20, 2010.

Certification Programme on "*Six Sigma Green Belt for L&T Executives*": SQC & OR Unit, Mumbai, December 7-9, 2010 and February 9-10, 2011.

Certification Programme on "*Six Sigma Green Belt for Reliance BPO Executives*": SQC & OR Unit, Mumbai, December 13-17, 2010.

Certification Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Mumbai, December 20-24, 2010.

Conferences and Seminars

Certification Programme on "*Six Sigma Green Belt for L&T Executives*": SQC & OR Unit, Mumbai, December 21-22, 2010 and February 12-14, 2011.

Certification Programme on "*Six Sigma Master Black Belt*": SQC & OR Unit, Mumbai, January 17-21, (1st Module) and February 21-25, 2011 (2nd Module).

Certification Programme on "*Six Sigma Green Belt*", SQC & OR Unit, Mumbai, March 21-25, 2011.

Training Programme on "*Training on SPC & MSA*": SQC & OR Unit, Pune, held at Lloyd's Register Quality Assurance Ltd., Mumbai, April 2–4, 2010.

Training Programme on "*Training Programme on DoE*": SQC & OR Unit, Pune, held at Armament R & D Establishment, October 18-20, 2010.

Training Programme on *"Training Programme on FMEA*": SQC & OR Unit, Pune, held at RAYCHEM RPG, Chakan, Pune, November 16-17, 2010.

Training Programme on "*Forecasting Techniques for Sales, Supply Chain & Purchase*": SQC & OR Unit, Pune, January 22-23 and February 5-6, 2011.

Training Programme on "*Executive Overview of Six Sigma*": SQC & OR Unit, Pune, February 18-19. 2011.

Workshop and Exhibition on "*Astronomy and Astrophysics: Concepts and Challenges*": Central Library, Kolkata with Physics and Applied Mathematics Unit, Kolkata, February 2-4, 2011.

National Workshop on "*Library 2.0 the next generation Library service in the digital era*" (under North-East Programme): Central Library, Kolkata, held at North-East Hill University, Shillong, March 7-9, 2011.

Workshop on "*Video Analysis and Surveillance (WVAS'10)*": Center For Soft Computing Research Center, Kolkata, July 6-10, 2010.

Workshop on "*Soft Computing and applications (WSCA'11)*": Center For Soft Computing Research Center, Kolkata with Institute of Technical Education and Research (ITER), Siksha 'O' Anusandhan (SOA) University, Bhubaneswar, held at ITER, SOA University, Bhubaneswar, Orissa, January 13-15, 2011.

Lectures and Seminars

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Asanuma, T., University of Toyama, Japan (28.02.2011): Topological aspects of the Jacobian conjecture.

Chakraborty, Arijit, Indian Institute of Science, Bangalore (01.06.2010): Large deviation for truncated heavy-tailed random variables.

Basu, Saugata, Pardue University (07.02.2011): Quantitative and effective questions in real algebraic geometry.

Bhattacharya, Amitava, School of Mathematics, Tata Institute of Fundamental Research (02.12.2010): Alternating reachability in colored graphs and matching theory.

Bhowmik, Gautami, Universite de Lille 1, France (09.08.2010): Zero sum sequences of groups.

Bolla, Marianna, Budapest University of Technology and Economics (31.12.2010): Mathematical Models in Biology.

Bolla, Marianna, Budapest University of Technology and Economics (03.01.2011): Spectral graph clustering.

Das, Abhiman, Reserve Bank of India, Mumbai (04.02.2011): Forecast distribution plot and its applications.

Das, Prosenjit, University of Burdwan (18.02.2011): Planes of the form $b(X,Y)Z^n - a(X,Y)$ over a DVR.

Datta, Basudeb, Indian Institute of Science, Bangalore (26.11.2010): A triangulation of CP^2 as a symmetric square of S^2.

Dey, Arijit, Indian Institute of Technology, Chennai (27.12.2010 & 28.12.2010): An introduction to Moduli of Torsion free sheaves.

Guntuboyina, Adityanand, Yale University, USA (21.07.2010): Minimax Lower bounds.

Krishnapur, Manjunath, Department of Mathematics, Indian Institute of Science, Bangalore (30.12.2010): How many real zeros does a random polynomial of degree n have?

Krishnapur, Manjunath, Department of Mathematics, Indian Institute of Science, Bangalore (31.12.2010): The Single Ring Theorem.

Kumar, Narasimha, Tata Institute of Fundamental Research, Mumbai (11.02.2011): On Local Galois Representations attached to Automorphic Form.

Mazumder, Satyaki, Department of Mathematical Sciences, University of Texas at Dallas (07.06.2010): Improving the Robustness of the Sample Spatial Outlyingness Functions through Spatial Trimming.

Mohari, Anilesh, Institute of Mathematical Sciences, Chennai (26.07.2010): G. Bikhoff's problem in irreversible quantum dynamics.

Mukherjee, Chiranjib, Max-Planck Institute for Mathematical Sciences, Leipzig (18.02.2011): Large deviations for Brownian intersection measures.

Munshi, Ritabrata, School of Mathematics, Tata Institute of Fundamental Research (16.09.2010): L-functions and applications.

Onoda, Nobuharu, University of Fukui, Japan (22.09.2010): Patching results on certain algebras.

Rao, B. V., Chennai Mathematical Institute (13.07.2010): Schramm-Lowner Evolution.

Roy, Sutanu, Department of Mathematics University of Goettingen, Germany (25.10.2010): Homomorphism of quantum groups.

Sainudiin, Raazesh, Department of Mathematics and Statistics, University of Canterbury, Christchurch, New Zealand (06.09.2010): Statistical algorithms over a dense tree of ordered binary trees.

Sang, Sarang, Tata Institute of Fundamental Research, Mumbai (11.02.2011): Euler class groups and Chow-Witt groups.

Thakur, Ajay, Institute of Mathematical Sciences, Chennai (24.11.2010): Complex Structures on Product of Circle Bundles over Compact Complex Manifolds.

Vadlamani, Sreekar, Tata Institute of Fundamental Research Centre for Applicable Mathematics, Bangalore (31.01.2011): Geometry of random fields in an infinite dimensional setting.

Vadlamani, Sreekar, Tata Institute of Fundamental Research Centre for Applicable Mathematics, Bangalore (03.02.2011): Geometric evolution under stochastic flows.

Wright, David, Department of Mathematics Washington University, St. Louis (16.08.2010): New conjectures related to the Jacobian Conjecture.

Stat-Math Unit, Delhi

Bendre, Sushama, North Eastern Hill University, Shillong (19.01.2011): Degradation models in reliability analysis.

Chakrabarty, Arijit, Indian Institute of Sciences, Bangalore (01.09.2010): Hill estimator for Truncated data.

Coletti, Cristian, Instituto de Matematica e Estatstica, Sau Paulo, Brasil (20.11.2010): New ergodicity conditions for a class of discrete time stochastic system with many components.

Doosti, Hassan, Teacher Training University, Tehran, Iran (16.03.2011): On linear wavelet density estimation: Some recent developments.

Karandikar, Rajeeva L., Chennai Mathematical Institute, Chennai (14.12.2010): Copulas, Tail Dependence and value at risk.

Karandikar, Rajeeva L., Chennai Mathematical Institute, Chennai (15.12.2010): Role of randomness in design and analysis of block Ciphers.

Kumar, Arun, Trinity University, San Antonio, Texas (02.02.2011): Sequential Calibration of Computer Models.

Murty, Ram, Queen's University, Canada (17.02.2011): The Circle method.

Prasad, Amritanshu, Institute of Mathematical Sciences, Chennai (28.04.2010): The Combinatorics of finite Abelian Groups.

Stute, Winfried, University of Giessen, Germany (05.01.2011): Model diagnosis of mixed linear models.

Tiwari, Ram, Center for Drug Evaluation and Research, FDA, USA (27.10.2010): A new method for signal detection with application to AERS data.

Stat-Math Unit, Bangalore

Araki, Huzihiro, Kyoto University, Japan (02.09.2010 & 03.09.2010): A new approach to quantum statistical mechanics.

Athreya, K.B., Indian Institute of Science, Bangalore and Iowa State University, USA (29.7.2010): An introduction to the raga structure of Indian Classical music.

Banerjee, Kalyan, Indian Institute of Technology, Kanpur (17.09.2010): How epidemics spread?

Belton, Alexander, Lancaster University, United Kingdom (20.01.2011): Quantum random walks.

Belavkin, V.P., University of Nottingham, United Kingdom (20.01.2011): Introduction into Quantum Entanglement and Information Theory.

Bhargava, Srinivasamurthy, Mysore University (Retd.), Mysore (14.10.2010): On a function which unifies the cubic analogues of the Jacobian theta function.

Borkar, Vivek, Tata Institute of Fundamental Research, Mumbai (08.06.2010): Stochastic approximation with `bad' noise.

Borkar, Vivek, Tata Institute of Fundamental Research, Mumbai (10.06.2010): Small noise limit of diffusions.

Brosnan, Patrick, University of British Columbia, Canada (11.08.2010): Admissible normal functions.

Chakrabarty, Arijit, Indian Institute of Science, Bangalore (12.04.2010): Hill estimator for truncated data.

Deshouillers, Jean-Marc, University of Bordeaux, France (17.03.2011): Some connections between probability theory and number theory.

Deshouillers, Jean-Mar, University of Bordeaux, France and Chairman of the examinations committee of Ecole Polytechnique in Paris (18.03.2011): Prime numbers: a proof of the unity of mathematics.

Dritschel, Michael, University of New Castle, United Kingdom (15.04.2010): Realizations via preorders.

Iyer, Srikanth, Indian Institute of Science, Bangalore (12.04.2010): Extended Random signal-to-interference-and-Noise-Ratio Graphs with Fading.

Kandikonda, Ravi, CRM Ogilvy & Mather Worldwide (27.08.2010): The Evolution and the Growing importance of Analytics in Industry.

Krishnapur, Manjunath, Indian Institute of Science, Bangalore (10.05.2010): Limit of characteristic polynomials of a random matrix.

Lindsay, Martin, University of Lancaster, United Kingdom (15.04.2010): Quantum semi-martingales.

Marianna, Bolla, Budapest University of Technology and Economics (05.01.2011): Perturbation Theory of Random Graphs.

Munshi, Ritabrata, Tata Institute of Fundamental Research, Mumbai (15.07.2010): The subconvexity problem.

Nair, Arvind N., Tata Institute of Fundamental Research, Mumbai (25.01.2011): Perfect cones and the decomposition theorem.

Nair, Arvind N., Tata Institute of Fundamental Research, Mumbai (27.1.2011): Lattice points in cones and values of zeta functions.

Rao, B.V., Chennai Mathematical Institute, Chennai (31.03.2011): Integration.

Ravichandran, Mohan, Sabanci University, Istanbul, Turkey (08.02.2011): Triangular algebras and non-selfadjoint extensions of von Neumann algebras.

Sainudiin, Raazesh, University of Canterbury, New Zealand (28.10.2010): Statistical algorithms over ordered binary trees.

Sainudiin, Raazesh, University of Canterbury, New Zealand (15.12.2010): Experiments with the site frequency spectrum.

Thatte, Bhalchandra, University of Oxford, UK (15.12.2010): Reconstructing population pedigrees.

Sethuraman, Bharath, California State University, Northridge and IIT, Mumbai (18.02.2011): Jet Schemes of Determinantal Varieties.

Shah, Riddhi, Jawaharlal Nehru University, New Delhi (15.07.2010): Orbits of distal actions.

Sunder, V.S., Institute of Mathematical Sciences, Chennai (24.01.2011): Hilbert von Neumann modules for dummies.

Tetenov, Andrey, Gorno-Altaisk State University, Russia (16.03.2011): Structural theorems for self-similar and self-affine curves.

Vasudeva, R., Mysore University, Mysore (10.02.2011): On the increments of Wiener Processes-almost sure behavior over subsequences.

Vavilov, Nikolai, St. Petersburg State University (17.02.2011): The Yoga of Commutators.

Venugopal, V., Indian Institute of Science, Bangalore (10.05.2010): On the changing patterns of Indian monsoon rainfall.

Yuri, Bilu, University of Bordeaux, France (05.08.2010): Galois representations and Runge's Method.

Applied Statistics Division

Applied Statistics Unit

Borissov, Yuri L., Institute of Mathematics & Informatics, Bulgaria (07.12.10): On jacket modulo prime matrices.

Sen, Sandeep, Indian Institute of Technology, Delhi (08.12.2010): A generalized model for update competitive algorithms.

Gong, Guang, Department of Electrical & Computer Engineering, University of Waterloo, Canada (09.12.2010): Composition analysis of stream ciphers snow 2, ZUC, grain and trivium.

Moudgalaya, Kannan, Department of Chemical Engineering, Indian Institute of Technology, Bombay (09.12.2010): Spoken tutorials: FOSS of the Mass.

Mandal, Abhyuday, University of Georgia (21.12.2010): Multi-objective optimal designs and social network models for identifying active brain regions in event-related fMRI studies

Mukherjee, Ashin, University of Michigan, Ann Arbor (11.01.2011): Reduced rank ridge regression and its kernel extensions.

Belmonte Matthew, K., Autism Research Centre, Cornell University, USA (02.02.2011): Harnessing within-group variance to understand autistic Neurophysiology and cognition.

Pantula, G.S., Mathematical Science, National Science Foundation, USA (03.02.2011): Unit root tests: A review.

Sabnis, S.V., Department of Mathematics, Indian Institute of Technology, Bombay (22.03.2011): Estimation of parameters in a mixture of two distribution functions using quantile functions.

Bayesian Interdisciplinary Research Unit

Behera, Narayan, Department of Molecular Reproduction, Development and Genetics, Indian Institute of Science, Bangalore (27.01.2011): An evolutionary data mining algorithm to find the candidate genes of a disease for medical diagnostics.

Behera, Narayan, Department of Molecular Reproduction, Development and Genetics, Indian Institute of Science, Bangalore (10.03.2011): Niche separation and species divergence in a heterogeneous environment.

Datta, Gauri Sankar, Department of Statistics, University of Georgia, USA (06.01.2011): Model Selection by Testing for the Presence of Small-Area Effects, and application to Area-Level Data.

Ghosh, Malay, Department of Statistics, University of Florida, USA (20.05.2010): Benchmarked Small Area Estimators.

Mazumder, Satyaki, Department of Mathematical Sciences, University of Texas at Dallas, USA (08.07.2010): Affine invariant, robust, computationally easy multivariate outlyingness functions.

Roy, T.K., Professor Emeritus and former Director, Indian Institute of Population Studies, Bombay (28.03.2011): Introduction aiming at the discussion on Experimentation, Quasi-experimentation, Standardization and Weighting: Similarity of Purposes.

Roy, T.K., Professor Emeritus and former Director, Indian Institute of Population Studies, Bombay (30.03.2011): Sampling designs in large scale surveys: Scope for making designs self-weighting.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit

Agustine, J.E., School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore (03.12.2010): Aligning Individual and Societal Interests via Subsidies.

Bandyopadhyay, S., School of Computer Science, University of Windsor, Canada (31.01.2011): Energy Aware Design Strategies for Relay based Sensor Networks.

Basu, A., Indian Institute of Management, Bangalore (18.11.2010): Zero-sum Risk-Sensitive Stochastic Differential Games.

Conferences and Seminars

Basu, A., Indian Institute of Management, Bangalore (08.03.2010): A Study on Equipartition of Measures.

Bhowmick, P., Indian Institute of Technology, Kharagpur (29.11.2010): Circles and Circularity: A Digital Geometric Perspective.

Chandran, Sunil L., Department of Computer Science and Automation, Indian Institute of Science, Bangalore (08.07.2010): Boxicity and Chromatic Number.

Chattopadhyay, A., Department Computer Science, University of Toronto, Canada (13.12.2010): Linear Systems over arbitary moduli.

Das, K., Department of Mathematics, Sungkyunkwan University, Republic of Korea (21.01.2011): Conjectures on eigenvalues and graph parameters.

Dasgupta, P., Department of Computer Science & Engineering, Indian Institute of Technology, Kharagpur (28.03.2011): Abstractions and Formalisms for Analog CAD.

Dhar, S., Associate Professor, Sen Jose State University (21.12.2010): Problems & Challenges for Mobile Ad Hoc Networks, Location-based Services and Advertising- from Industry perspective.

Govindarajan, S., CSA Department, Indian Institute Science, Bangalore (02.08.2010): Conflict-Free Coloring for Rectangle Ranges.

Laskar, R., Department of Mathematical Sciences, Clemson University, USA (27.07.2010): Quorum colorings of graphs.

Majumdar, S., Carleton University, Ottawa, Canada (01.12.2010): Mobile Web Service: challenges and Answers.

Mishra, P., Department of Computer and Information Science and Engineering (CISE), University of Florida (11.08.2010): Design Automation of Embedded and Reconfigurable System.

Roy, S., Chennai Mathematical Institute (09.12.2010): Querying for certain kind of geometric object satisfying certain property.

Saidur Rahaman, Md., Bangladesh University Engineering and Technology (BUET), Dhaka, (21.02.2011): Pairwise Compatibility Graphs.

Saurabh, S., The Institute of Mathematical Sciences, Chennai (13.07.2010): Kemelization: A Survey.

Sen, S., Indian Institute of Technology, Delhi (16.12.2010): Efficient Maintenance of Maximum Matching in Dynamic Graphs.

Sikdar, S., RWTH, Aachen, Germany (13.07.2010): Kemelization: A Survey.

Sinha, A., Indian Institute of Management, Bangalore (22.12.2010): Trace Based Predictive Analysis of Concurrent Software.

Computer Vision and Pattern Recognition Unit

Abed, H.E., Technische Universität Carolo Wilhelmina zu Braunschweig (TUBS), Germany (15.11.2010): Handwritten Text / Word Recognition Systems – Conception, Approaches and Evaluation.

Blumenstein, M., Griffith University, Australia (15.11.2010): Signature Verification - Forensic Examiners' Perception and Solutions for Off-Line and On-Line Signatures.

Fink, G.A., TU Dortmund, Department of Computer Science, Dortmund, Germany (15.11.2010): Markov Models for Handwriting Recognition.

Found, B., Signature & Handwriting Forensics Pty Ltd., Australia (15.11.2010): Signature Verification - Forensic Examiners' Perception and Solutions for Off-Line and On-Line Signatures.

Heuvel, E.van den, Netherlands Forensic Institute, The Netherlands (15.11.2010): Signature Verification - Forensic Examiners' Perception and Solutions for Off-Line and On-Line Signatures.

Liwicki, M., German Research Center for Artificial Intelligence, Germany, (15.11.2010): Signature Verification - Forensic Examiners' Perception and Solutions for Off-Line and On-Line Signatures.

Märgner, V. Technische Universität Carolo Wilhelmina zu Braunschweig (TUBS), Germany (15.11.2010): Handwritten Text / Word Recognition Systems – Conception, Approaches and Evaluation.

Thomas, A.O., Bhardwaj, A., University of Buffalo, USA (15.11.2010): Information Retrieval from Handwritten Documents.

Toselli, A.H., Pastor, M. and Romero, V., Universitat Politècnica de València, Spain (15.11.2010): Multimodal Computer Assisted Transcription of Handwriting Images.

Documentation Research and Training Centre

Irene, Wormel, Information Management, Swedish School of Library and Information Science, University of Gothenburg, Sweden (08.12.2010): Information Management Vs Knowledge Management.

Irene, Wormel, Information Management, Swedish School of Library and Information Science, University of Gothenburg, Sweden (14.12.2010): Information Consultancy – success factors and challenges.

Peter, Ingwersen, Department of Information Studies, The Royal School of Library and Information Science, Denmark (07.12.2010): Information Science in International Perspective.

Peter, Ingwersen, Department of Information Studies, The Royal School of Library and Information Science, Denmark (13.12.2010): Laboratory Information Retrieval and the Cognitive IR Research Framework.

Electronics and Communication Sciences Unit

Bhowmik, D., The University of Sheffield, UK (05.01.2011): Scalable Coded Video Watermarking Techniques using Motion Compensated 2D+t+2D Filtering.

Bhunia, S., Medtronic, USA (28.07.2010): Active Implantable Cardiac Devices.

Das, S., Jadavpur University, Kolkata (03.03.2011): On Convergence, Stability, and Explorative Behavior of Modern Evolutionary Optimization Techniques – an Analytical View.

Conferences and Seminars

Dutta, K., College of Business, Florida International University, USA (07.01.2011): Maintaining High Quality of Service for Organizational Processes through Efficient Root Cause Analysis.

Mitra, K., ECE Department, University of Maryland, USA (17.01.2010): Handling Outliers and Missing Data in Statistical Data Models with Applications to Computer Vision.

Thompson, R., University of Guanajuato, Mexico (21.02.2011): Challenges in Electronic Art.

Machine Intelligence Unit

Arias-Montario, Alfredo, Department of Computer Sciences, CINVESTAV-IPN, Mexico (25.08.10): Multi-Objective Aerodynamic Shape Optimization Using Evolutionary Algorithms.

Lingras, P., Department of Mathematics and Computer Science, Saint Mary's University, Canada (02.03.11): Applications of Rough Clustering: Evolutionary, K-means, and Kohonen Based Approaches.

Nath, B., Department of Computer Science & Engineering, Tezpur University, Assam (10.02.2011): Association Rule Mining: An Overview of Concepts and Challenges.

Baragona, R., Department of Communication and Social Research, Sapienza, University of Rome, Itally (17.02.11): Structural Breaks in Time Series.

Systems Science and Informatics Unit

Banerjee, A., NIH, Bethesda, Maryland, USA (14.03.2011): Decoding trail-by-trail information processing from brain electric activity.

Banerjee, A., NIH, Maryland, USA (16.03.2011): Neurocognitive networks underlying goal directed behaviour.

Beira, E., EDAM, MIT Portugal Program School of Engineering, Portugal (15.02.2011): Engineering design & advanced manufacturing: the MIT Portugal experience.

Bhalla, U.S., NCBS, Bangalore (14.03.2011): Brain, mind and models.

Bhagvathi, C., Department of Computer of Informatics Systems, University of Hyderabad (25.10.2010): Applications of mathematical morphology in texture defect analysis.

Cousty, J., Université Paris-Est, ESIEE, France (19.10.2010): Graphs.

Cousty, J., Université Paris-Est, ESIEE, France (20.10.2010): Component tree.

Cousty, J., Université Paris-Est, ESIEE, France (21.10.2010): Watershed on edge graphs – I & II.

Cousty, J., Université Paris-Est, ESIEE, France (26.10.2010): Graph based mathematical morphology.

Dasgupta, D., Department of Computer Science, University of Memphis, USA (16.12.2010): Advances in Immunological Computation.

Deriche, R., INRIA, Sophia Antipolis, France (15.03.2011): Computational diffusion MRI: From images to anatomical connectivities in the brain and beyond.

Iyengar, S.S., Department of Computer Science, University Louisiana State, USA (20.12.2011): Visual Information Retrieval Systems: Theory & Practice.

Iyengar, S.S., Department of Computer Science, Louisiana State University, USA (31.03.2011): Content Based Information Retrieval.

Jain, N., NBRC, Manesar, Haryana (15.03.2011): Effects of spinal cord injuries on the brain – interventions using brain machine interface devices.

John, J. P., NIMHANS, Bangalore (14.03.2011): Aberrant cognitive processing in schizophrenia: Insights from FMRI research.

Kiselman, C.O., Department of Mathematics, Uppsala University, Sweden (02.09.2010): Local minima, marginal functions, and separating hyperplanes in discrete optimization.

Kiselman, C.O., Department of Mathematics, Uppsala University, Sweden (02.09.2010): Inverses and quotients of mappings between ordered sets.

Krishnamurthy, N., Chennai Mathematical Institute, Chennai (30.03.2011): Some Tractable Win – Lose Games.

Kumar, V.M., SCTIMST, Thiruvananthapuram (15.03.2011): Quantitative and qualitative analysis of sleep: past, present and future.

Najman, L., Université Paris-Est, ESIEE, France (22.10.2010): Hierarchical segmentation.

Najman, L., Université Paris-Est, ESIEE, France (26.10.2010): Power watershed: a unifying graph-based optimization framework.

Pina, P., Universidade Técnica de Lisboa, Portugal (25.10.2010): Mathematical morphology in planetary surfaces characterization.

Rao, C.B., Indira Gandhi Centre for Atomic Research, Kalpakkam (25.10.2010): Contour based Classification.

Rao, P.N., Indian Institute of Space Science and Technology, Trivandrum (26.10.2010): Morphological Hyperspectral Image Classification – Integration of Spectral and Spatial Information.

Ranjan, U., Philips Healthcare, Bangalore (26.10.2010): Image processing related activities at Philips Health Care.

Serra, J., Université Paris-Est, ESIEE, France (19.10.2010): Lattices.

Serra, J., Université Paris-Est, ESIEE, France (19.10.2010): Erosion.

Serra, J., Université Paris-Est, ESIEE, France (20.10.2010): Binary connectivity.

Serra, J., Université Paris-Est, ESIEE, France (20.10.2010): Numerical Connectivity.

Serra, J., Université Paris-Est, ESIEE, France (21.10.2010): Connective segmentation.

Serra, J., Université Paris-Est, ESIEE, France (22.10.2010): Morphological colour processing.

Serra, J., Université Paris-Est, ESIEE, France (25.10.2010): Historical overview of image analysis and mathematical morphology.

Singh, R., Indian Research Lab, IBM, Delhi (14.03.2011): Network architecture of the long – distance pathways in the macaque brain.

Sripati, A., Indian Institute of Sciences, Bangalore (15.03.2011): Why vision is a hard but interesting problem.

Vaidya, V.A., Tata Institute of Fundamental Research, Mumbai (14.03.2011): The emotional brain: Imprints of life history.

Physics and Earth Sciences Division

Geological Studies Unit

Basu, Abhijit, Indiana University Bloomington, USA (07.02.2011): Robust Geochronology and Events in Purana Basins.

Chalapathi Rao, N.V., Centre of Advanced Study in Geology, Banaras Hindu University, Varanasi (12.11.2010): Some new evidence from kimberlites on the origin and original spatial extent of the Purana sedimentary basins and the Deccan flood basalts.

Harasewych, M.G., National Museum of Natural History, Smithsonian Institution, Washington DC, USA (27.07.2010): The origins, phylogeny, ecology and biogeography of deep-sea slit snails.

Hartley, Adrian, Department of Geology and Petroleum Geology, School of Geosciences, University of Aberdeen, UK (05.01.2011): Semi Quantitative Analysis of Modern Distributive Fluvial System.

Weissmann, Gary, Department of Earth and Planetary Sciences, University of New Mexico, USA (05.01.2011): Fluvial Form and Sedimentary Architecture in Modern Continental Basisns- Studies and Geostatistical Models Using Satellite Imagery and Subsurface Data.

Physics and Applied Mathematics Unit

Balasubramanian, Ganesh, State University of Virginia (31.05.2010): Understanding transport phenomena at the naroscale using mocular dynamics.

Dutta, Prasun, Department of Physics & Meterology, Indian Institute of Technology, Kharagpur (04.06. 2010): Turbulence in the interstellar medium of galaxies.

Daripa, Prabir, Department of Mathematics, Texas A & M University, College Station, USA (29.7.2010): Thin film problems in fluid mechanics.

Das, Shantanu, Reactor Control Division, Bhabha Atomic Research Centre, Mumbai (03.12.2010): Application of fractional calculus.

Ghosh, Sibasish, Institute of Mathematical Sciences, Chennai (05.05.2010): Dynamics of open quantum systems-I.

Ghosh, Sibasish, Institute of Mathematical Sciences, Chennai (12.5.2010): Dynamics of open quantum systems-II.

Lahti, Pekka, Department of Physics & Astronomy, University of Turku, Finland (14.12.2010): Measuring together complementary quadrature observable in quantum mechanics.

Rauch, Helmut, Vienna University of Technology, Austria (11.01.2011): Basic features of quantum physics studied with neutrons.

Sarkar, Sujit, Poornaprajna Institute of Scientific Research, Bangalore, (12.01.2011): Non-universal tunneling resistance at the quantum critical point of a mesoscopic SQUIDs arra.

Sarkar, Sujit, Poornaprajna Institute of Scientific Research, Bangalore (21.03.2011): Perfect entanglement transport in quantum spin chain.

Sarkar, Swarnendu, Department of Physics & Astrophysics, Delhi University, (10.03.2011): Holographic BCS instability at finite baryon densities.

Sasaki, Ryu, Institute of Theoretical Physics, University of Kyoto, Japan (10.12.2010): Discrete quantum mechanics and exceptional orthogonal polynomials.

Tollaksen, Jeff, Center for Quantum Studies, Chapman University, USA (11.01.2011): Weak measurements and time-symmetry in quantum mechanics.

Biological Sciences Division

Agricultural and Ecological Research Unit

Bhattacharyya, P., Department of Renewable Resources, College of Agriculture, University of Wyoming, Laramie, USA (03.02.2011): Evaluation of Calcutta municipal solid waste compost for crop production with special reference to metals fractionations and soil microbiological quality.

Dress, A., Director, Department of Combinatorics and Geometry, Shanghai Institutes for Biological Sciences, Shanghai (07.02.2011): Visualizing viral evolution.

Feudel, Ulrike, Theoretical Physics/Complex Systems, Institute for Chemistry and Biology of the Marine Environment, Carl von Ossietyky University Oldenburg, Germany (07.03.11): Spatio-temporal patterns in simple models of marine systems

Ghosh, P., Department of Biological Sciences, University of Alabama, USA (07.01.2011): Geospatial Mercury concentrations in fish from two fresh water ecosystems in the Southeastern United States.

Human Genetics Unit

Elston, R.C., Case Western Reserve University, Cleveland, Ohio, USA (12.01.2010): History of the Elston-Stewart Algorithm.

Elston, R.C., Case Western Reserve University, Cleveland, Ohio, USA (13.01.2010): Single – Marker and Two-Marker association tests for Unphased case-control genotype data.

Kundu, G., NCCS, Pune (25.11.2010): Significance of Ostioponting as a diagnostic marker in breast cancer.

Mukherjee, S., Utkal University (21.05.2010): Modulation of hepatic and testicular antioxidant defense system in adult rats.

Mookerjee, A., University of Pennsylvania School of Medicine, USA (21.10.2010): Overcoming drug resistant cancer through.

Sen, S. Division of Biostatistics, UCSF, USA (01.03.2010): Selective genotyping and phenotyping in a complex trait context.

Social Sciences Division

Economic Research Unit

Bandyopadhyay, Subhayu, Research Division, Federal Reserve Bank of St., USA (24.06.2010): An Evaluation of the Employment Effects of Barriers to Outsourcing.

Bhattacharya, Kaushik, Indian Institute of Management, Lucknow (10.06.2010): Emergence of Independent Candidates: A Negative Binomial Regression Model of an Indian Parliamentary Election.

Bhattacharya, Sourav, Department of Economics, University of Pittsburgh, USA (08.08.2010): Resistance to Outside Investment: A Rational Model of Surplus Destruction.

Bhattacharya, Debopam, University of Oxford, UK (10.01.2011): Evaluating treatment protocols using data combination.

Chatterjee, Arpita, University of New South Wales, USA (07.01.2011): Who do Similar Countries Choose Different Policies? Endogenous Comparative Advantage & Welfare Gains.

Chaudhury, Kausik, Leeds University Business School, UK (06.04.2010): Clustering, Inter-Family Heterogeneity and School Attendance.

Das, Kaustav, Department of Economics, Penn State University, USA (28.07.2010): Competition in Buyer-Seller Markets: One-Sided Simultaneous Offers Bargaining.

Dey, Malay, Independent, Fairfield, CT 06824, U.S.A., (22.07.2010): New Directions in Financial Econometrics.

Ghosh, Sambudha, Department of Economics, Boston University, USA (05.01.2010): Repeated Adverse Selection: Insurance.

Ghosh, Saptarshi, Department of Economics, University of Birmingham, UK (06.01.2010): Quality, Reputation and Leakage of Expert Advice.

Gupta, Sudip, Indian School of Business, Bangalore (09.03.2011): Why and When to Go Public: A Structural Estimation?

Kundu, Tapas, Department of Economics & ESOP, University of Oslo, Norway (04.04.2010): Conflict and Mobility: Resource Sharing in Groups.

Maitra, Sudeshna, Department of Economics, York University, Canada (14.02.2011): Population Dynamics and Marriage Payments: An Analysis of the Long Run Equilibrium in India.

Mukherjee, Anirban, Globsyn Business School, Kolkata (17.02.2011): Transition of Credit Institutions: Theory and Evidence.

Ray, Ranjan, Department of Economics, Monash University, Australia (30.11.2010): Multi Dimensional Deprivation in the Awakening Giants: A Comparative Study on Micro Data.

Sen, Debapriya, Department of Economics, Canada (02.09.2010): Relative and Absolute Preference for Quality.

Planning Unit

Alonso, Irasema, Yale University (24.12.2010): Endogenous Aggregate Beliefs: Equity Trading Under Heteogeneity in Ambiguity Aversion.

Ambec, Stephan, Toulouse School of Economics (18.03.2011): Regulation via the Polluter-pays Principle.

Bell, Clive, University of Heidelberg (24.09.2010): Estimating the Social Profitability of PMGSY: A Bumpy Ride.

Bhattacharya, Debopam, University of Oxford (30.07.2010): On Detecting Discrimination in Treatment Assignment.

Borah, Abhinash, University of Pennsylvania and Visitor at Center for Development Economics, Delhi School of Economics (26.11.2010): Other-regarding Preferences and Concerns for Procedures.

Chatterji, Shurojit, Singapore Management University (08.10.2010): On Domains that Admit well Behaved Strategy Proof Social Choice Functions.

Ghosh, Parikshit, Delhi School of Economics (25.03.2011): Repeated Elections and Policy Persistence.

Goldstein, Daniel, Yahoo! Research and London Business School (07.09.2010): The Future of Investing and Saving (or Technologies for Ensuring Secure Financial Futures).

Lahkar, Ratul, IFMR, Chennai (10.12.2010): Reinforcement Learning in Evolutionary Games.

Marjit, Sugata, CSSS, Kolkata (20.02.2011): Conflicting Measures of Poverty and Inadequate Saving by the Poor-The Role of Status Driven Utility Function.

Mukherjee, Deep, University of Connecticut (14.01.2011): Assessing the Linkage Between Dairy Production Efficiency and Climatic Conditions: A Case Study of Florida.

Mukherjee, Sanchita, University of California, Santa Cruz (25.01.2011): The Effects of Capital Market Openness on Exchange Rate Pass-through and welfare in an Inflation-Targeting Small Open Economy.

Murthy, Sushma, University of Warwick, UK (27.07.2010): On Modeling Pollution-Generating Technologies.

Nagarajan, Hari K., National Council of Applied Economic Research (16.04.2010): Can Changes in Inheritance Legislation Improve Female Asset ownership? Evidence from India's Hindu Succession Act.

Perry, Motty, Hebrew University of Jerusalem and University of Warwick (05.01.2011): Dynamic Contracts with Adverse Selection and Moral Hazard.

Poddar, Sougata, Nanyang Technological University, Singapore (07.01.2011): Accommodation or Deterrence in the Face of Commercial Piracy: The Impact of Intellectual Property Rights (IPR) Protection.

Conferences and Seminars

Sethi, Rajiv, Columbia University (06.08.2010): Economic Consequences of Speculative side Bets: The Case of Naked Credit Default Swaps.

Shalabh, Indian Institute of Technology, Kanpur (11.11.2010): Consistent Estimation Regression Coefficients in Replicated Ultra structural Model.

Single, Saurabh, University of Southern California ((13.08.2010): The Economic Costs of Naxalise Violence and the Economic Benefits of a Unique Robust Security Response.

Sprumont, Yves, University of Montreal (01.10.2010): An Axiomatization of the Serial Cost Sharing Method.

Subramanian, Arvind, Peterson Institute for International Economics (01.03.2011): Is Newer Better? Penn World Table Revisions and their Impact on Growth Estimates.

Tiwari, Amresh K., University of Maastricht, The Netherlands (09.04.2010): Financial Constraints, Capital Structure and Innovation: An Empirical Investigation.

Veronese, Giovanni, Bank of Italy (12.11.2010): A Policy-Sensible Benchmark Core Inflation Measure: An Application to Euro Area and US Data.

Vohra, Rakesh, Kellogg School of Management (21.01.2011): Calibration Respice, Adspice, Prospice.

Winter, Ralph, University of British Columbia (28.01.2011): Innovation and the Dynamics of Global Warming.

Population Studies Unit

Acharya, Rajib, Population Council, Lucknow (11.10.2010): Youth in India: Situation and Needs 2006-2007.

Dwivedi, L.K., Tata Institute of Social Sciences, Mumbai (27.01.2011): Impact of Antenatal Care Visits on Institutional Delivery in India: A Propensity Score Matching Analysis.

Ghosh, Saswata, Institute of Development Studies, Kolkata (20.12.2010): Can the Simplified Heligman-Pollard Model Mortality Schedule be Fitted to the Grouped Data?

Pathak, C.R., Ex-Professor and Head, Department of Architecture and Regional Planning, Indian Institute of Technology, Kharagpur (15.02.2011): Urbanisation in India and the Management of Mega Cities.

Sociological Research Unit

Dixit, Anita, Centre for Economics Studies and Planning, Jawaharlal Nehru University (26.01.2011): Regional Inequality - A Review of Literature.

Sen, Sudarshana, Alia University (4.03.2011): Anglo-Indian Women, Some Reflections on Their Experiences.

Swaminathan, Hema, and Lahoti, Rahul Indian Institute of Management Bangalore (22.03.2011): In her Name: Gender Asset Gap in Karnataka.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Coimbatore

Bakthavatshalam, K.G., Padma Shree (29.06.2010): How Statistics helps in Clinical Research.

SQC & OR Unit, Kolkata

Singpurwalla, N.D., George Washington University, USA (09.02.2011): Network Survivability under Interdependence.

Singpurwalla, N.D., George Washington University, USA (09.02.2011): A Dynamic Competing Risk Model for Filtering Reliability and Tracking Survival.

Chatterjee, Aditya, Calcutta University, Kolkata (09.02.2011): Statistical issues of Surveillance.

Mukhopadhyay, Chiranjit, Indian Institute of Science, Bangalore (09.02.2011): Repairable System Reliability Estimation with Repair Times as Covariates.

Library, Documentation and Information Sciences Division

Goswami, P.K., Director, Central Secretariat Library, New Delhi (26.02.2011): Census – Reference Librarianship.

Nankana, A.N., Former Head, SQC & OR Unit, ISI, Delhi Centre (21.08.2010): Expectations from the Libraries.

Pandey, Kiran, Centre for Science and Environment (CSE), New Delhi (01.05.2010): Reinventing Libraries in the Digital Era: Case study on India Environment Portal, the Virtual gateway to environment and Developmental Information.

Raghavan, M.C., UN Consultant to Govt. of Vietnam at Cambodia and Former Head-LIS, Center Road Research Institute, New Delhi (21.08.2010): Dr. Ranganathan as my Guru.

Center for Soft Computing Research: A National Facility

Das, A., Pennsylvnia College of Technology (02.08.2010): Granularity – a software engineering approach.

Ghosh, P., Viterbi School of Engineering, University of Southern California, USA (13.12.2010): A computational framework for exploring the role of speech production in speech processing/recognition.

Hashimoto, R.F., University of Sao Paulo (USP), Brazil (09.09.2010): Growing Seed Network.

Hashimoto, R. F., University of Sao Paulo (USP), Brazil (09.09.2010): Gene Interactions Analysis.

Conferences and Seminars

Lingras, P., Department of Mathematics and Computing Science, Saint Mary's University Halifax, Canada (28.02.2011): Rough sets: reasoning with incomplete and imprecise information.

Martins Jr., D.C., Federal University of ABC (UFABC), Brazil (08.09.2010): SFFS-MR: a floating search strategy for GRNs inference.

Martins Jr., D.C., Federal University of ABC (UFABC), Brazil (08.09.2010): Gene Regulatory Networks Inference.

Martins Jr., D.C., Federal University of ABC (UFABC), Brazil (08.09.2010): Regulation in Gene-Expression Pathways and Its Relationship with Intrinsically Multivariate Predictive Genes.

Pal, R, Department of CSE, IIT Kharagpur, India (19.11.2010): Modeling Visual Saliency and Application.

5. SANKHYA

The internationally renowned journal *Sankhya* was founded by Professor P.C. Mahalanobis in 1932 and began publication under his editorship. It is devoted to original research articles in Mathematical Statistics, Probability and Applied Statistics. Reviews and discussion articles in area of current research activity are also published. Many seminal articles in the above areas have appeared in *Sankhya.* *Sankhya* receives articles from all over the world and publishes only those which pass the rigorous peer review process. The Editorial Board of *Sankhya* includes internationally reputed scholars in relevent areas from all over the world. The compositions of the Editorial Boards that served the journal during 2009-10 appear in Part III, Section 10 of the Report.

From 2003, *Sankhya* has been published in a single series, four times a year in February, May, August and November. Certain issues came out as a special issue devoted to a particular field.

From 2008 *Sankhya* is being published in a two series format, Series A and Series B. Series A covers Theoretical Statistics and Probablity while Series B caters to Applied and Interdisciplinary Statistics. Series A is publishing two issues per year, in February and August, and Series B is publishing two issues per year, in May and November, respectively.

The following issues have been published during April 2010 to March 2011.

- February 2010 : Volume 72 Part I, Series A
- May 2010 : Volume 72 Part I, Series B

The August 2010 issue Volume 72 Part II, Series A is print Edition in Press.

The following issues are currently under process for publication:

- November 2010 : Volume 72 Part II, Series B
- February 2011 : Volume 73 Part I, Series A

Editor-in-Chief : Pranab K. Sen,
Editors: Series A : Krishna B. Athreya, Alok Goswami, Soumendra N. Lahiri
Editors: Series B : Ayanendranath Basu, Malay Ghosh, Bimal K. Sinha

6. SCIENTIFIC PAPERS AND PUBLICATIONS

Books Published

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Delhi

Bapat, R.B.: *Graphs and Matrices*, Hindustan Book Agency, Delhi, TRIM Series and Springer-Verlag, New York, Universitext Series, pages 171, 2010.

Applied Statistics Division

Applied Statistics Unit

Chatterjee, S. and Sarkar, P.: *Identity-Based Encryption*, Springer, pages 191, 2011.

Chaudhuri, A.: *Randomized Response and Indirect Questioning Techniques in Surveys*, Chapman & Hall/ CRC, Taylor & Francis Group, Boca Raton, Florida, USA, pages 228, 2010.

SenGupta, A.: *Probability Distributions for Directional Data*, Maresias, Brazil, 2010.

Wells, M.T. and SenGupta, A. (eds.): *Advances in Directional and Linear Statistics: A Festschrift for Sreenivasa Rao Jammalamadaka,* Physica-Verlag, Berlin Heidelberg, pages 321, 2011.

Bayesian and Interdisciplinary Research Unit

Bandyopadhyay, S., Rao, A.R. and Sinha, B.K.: *Models for Social Networks with Statistical Applications*, Advanced Quantitative Techniques in the Social Sciences Series, Vol. 13, Sage Publications. USA, pages 256, 2011.

Computer and Communication Sciences Division

Computer Vision and Pattern Recognition Unit

Chaudhuri, Bidyut B.: *Bangla Sound Symbolism: Properties and Dictionary*, West Bengal Bangla Academy, Kolkata, 2010.
Garain, Utpal: *Machine Recognition of Mathematical Expressions*, Lambert Academic Publishing (LAP), Germany, 2010.

Documentation Research and Training Centre

Ravichandra Rao, I.K.: *Growth of Literature and Measures of Scientific Productivity,* Ess Ess Publication (Published for Sarada Ranganathan Endowment for Library Science, Bangalore), New Delhi, pages 94, 2010.

Electronics and Communication Sciences Unit

Mukherjee, D.P. and Jana, D.: *Computer Graphics*: *Algorithms and Implementations*, Prentice Hall, India, pages 512, ISBN: 9788120340893, 2010.

Machine Intelligence Unit

Maulik, U., Bandyopadhyay, S. and Wang, J.T.L. (eds.): *Computational Intelligence and Pattern Analysis in Biological Informatics*, Wiley Interscience, USA, 2010.

Systems Science and Informatics Unit

B.S.D., Sagar and J., Serra (eds.): *A Special Issue on Spatial Information Retrieval, Analysis, Reasoning and Modelling*, International Journal of Remote Sensing, Taylor & Francis, 2010.

Physics and Earth Sciences Division

Physics and Applied Mathematics Unit

Abraham, R. and Roy, S.: *Demystifying the Akasa; Consciousness and Quantum Vacuum*, Publishers Epigraph, New York, 2010.

Mandal, B.N. and Chakrabarti, A.: *Applied Singular Integral Equations*, Science Publishers / CRC Press, USA, 2011.

Social Sciences Division

Economic Research Unit

Mitra, Manipushpak, Abergel, Frederic, Chakrabarti, Bikas, K., and Chakraborti, Anirban (eds.): *Econophysics of Order-driven Market,* New Economic Window Series, Springer, Italy, 2011.

Linguistic Research Unit

Camacho, Jorge, Dasgupta, Probal and Ertl István (eds.): *Beletra Almanako 7*, Mondial, New York, 2010.

Camacho, Jorge, Dasgupta, Probal and Ertl István (eds.): *Beletra Almanako 8*, Mondial, New York, 2010.

Camacho, Jorge, Dasgupta, Probal and Ertl István (eds.): *Beletra Almanako 9*, Mondial, New York, 2010.

Camacho, Jorge, Dasgupta, Probal and Ertl István (eds.): *Beletra Almanako 10*, Mondial, New York, 2011.

Dash, Niladri Sekhar: *Modern Bengali Script: An Introduction* (Paperback), Daksha Bharati, Kolkata Pages 235+, 2010.

Dash, Niladri Sekhar: *A Descriptive Study of the Modern Bengali Script* (Paperback), Lambert Academic Publishing, Saarbrucken, Germany, pages 309, 2011.

Dash, Niladri Sekhar: *Annotation Guidelines for Bengali Text Corpus*, Department of Information Technology, Govt. of India, pages 1-55, 2011.

Psychology Research Unit

Dutta Roy, D.: *Principles of Questionnaire Development with empirical studies*, Prasad Psycho Corporation, New Delhi, pages 141, 2011.

Sociological Research Unit

De U.K. and Ghosh, Bholanath (eds.): *Gender Deprivation and Empowerment of women: An Indian perspective*, Lap Lambert Academic Publishing GmbH & Co, Saarbrucken, West Germany, 2011.

Center for Soft Computing Research: A National Facility

Pal, S.K. and Peters, J.F. (eds.): *Rough-Fuzzy Image Analysis: Foundations and Methods,* Chapman & Hall/CRC, Boca Raton, Florida, pages 266, 2010.

Papers Published in Journals

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Bandyopadhyay, Pradipta and Paul, Tanmoy: Ball remotality in Banach spaces, *Jounral Mathematics Analysis Application,* **369 (2)**, 525–536, 2010.

Bandyopadhyay, Pradipta, Paul, Tanmoy and Roy, Ashoke K.: Ball remotality of M-ideals in some function spaces and function algebras, *Positivity*, **14 (3)**, 459–471, 2010.

Banica, T. and Goswami, Debashish: Quantum isometries and noncommutative spheres, *Commun. Mathematics Physics*, **298 (2)**, 343-356, 2010.

Basak, Anirban and Bose, Arup: Balanced random Toeplitz and Hankel matrices, *Electronic Communications in Probability,* **15**, 134-148, 2010.

Bhowmick, J., Goswami, Debashish and Skalski, A.: Quantum isometry groups of 0-dimensional manifolds, *Transactions of the American Mathematical Society*, **363 (2)**, 901-921, 2011.

Bhowmick, J. and Goswami, Debashish: Some counterexamples in the theory of quantum isometry groups, *Letters in Mathematical Phyics*, **93 (3)**, 279-293, 2010.

Biswas, I. and Poddar, M.: Chen-Ruan cohomology of some moduli spaces - II, *International Journal of Mathematics*, **21 (4)**, 497–522. 2010.

Bose, Arup: The ET interview: B.L.S. Prakasa Rao, *Econometric Theory*, **27**, 1-39, 2011.

Bose, Arup, Gangopadhyay, Sreela and Sen, Arnab: Limiting spectral distribution of $XX' matrices, *Annales de l'Institut Henri Poincare--Probabilites et Statistiques*, **46(3)**, 677-707, 2010.

Bose, Arup, Hazra, Rajat Subhra and Saha, Koushik: Spectral norm of circulant type matrices with heavy tailed entries, *Electronic Communications in Probababilty*, **15**, 299-313, 2010.

Bose, Arup, Hazra, Rajat Subhra and Saha, Koushik: Spectral norm of circulant type matrices, *Journal of Theoretical Probability*, **24 (2)**, 479-516, 2011.

Bose, Arup, Pal, Debashis and Sappington, David: Asymmetric treatment of identical agents in teams, *European Economic Review*, **54**, 947-961, 2010.

Bose, Arup, Pal, Debashis and Sappington, David: On the performance of linear contracts, *Journal of Economics & Management Strategy*, **20** (1), 159-193, 2011.

Bose, Arup, Pal, Debashis and Sappington, David: Pareto-improving inefficiency, *Oxford Economics Papers*, **63 (1)**, 94-110, 2011.

Das, Mrinal K. and Sridharan, Raja: Good invariants for bad ideals, *Journal of Algebra,* **323**, 3216-3229, 2010.

Das, Mrinal K. and Sridharan, Raja: Euler class groups and a theorem of Roitman, *Journal of Pure and Applied Algebra*l, **215**, 1340-1347, 2011.

Datta, Mahuya: Immersions in a manifold with a pair of symplectic forms, *Journal of Symplectic Geometry*, **9 (1)**, 11-32, 2011.

Dhar, Subhra, S. and Chaudhuri, Probal: On the statistical efficiency of robust estimators of multivariate location, *Statistical Methodology*, **8**, 113-128, 2011.

Kumar, P., Ray, Swagato K. and Sarkar, Rudra P.: The role of restriction theorems in harmonic analysis on harmonic NA groups, *Journal of Functional Analysis*, **258**, 2453–2482, 2010.

Poddar, M. and Sarkar, S.: On quasitoric orbifolds, *Osaka Journal* Mathematics, **47(4)**, 1055-1076, 2010.

Sen, Debasis and Mukherjee, Goutam: Equivariant simplicial cohomology with local coefficients and its classifications, *Topology and its applications*, **157**, 1015-1032, 2010.

Publications

Sen, Debasis and Mukherjee, Goutam: On a Theorem of Eilenberg in simplicial Bredon-Illman cohomology with local coefficients, *International Journal of Mordern Mathematics*, **5(3)**, 339-359, 2010.

Stat-Math Unit, Delhi

Bandyopadhyay, Antar: Endogeny for the logistic recursive distributional equation, *Zeitschrift fur Analysis und ihre* Anwendungen, **30(2)**, 237-251, 2011.

Bandyopadhyay, Antar, Roy, Rahul, and Sarkar, Anish: On the one dimensional "learning from neighbours" model, *Electronics Journal Probabability – 15*, **51**, 1574-1593, 2010.

Bandyopadhyay, Antar, Steif, Jeffrey, and Timar, Adam: On the cluster size distribution for percolation a on some general graphs, *Revista Matematica Iberoamericana*, **26(2)**, 529-550, 2010.

Bapat, R.B.: On a conjecture concerning spanning tree invariants and loop systems, *Linear Algebra and Its Applications*, **433**, 1642-1645, 2010.

Bapat, R.B.: Least-squares approximation by a tree distance, *Contributions to discrete mathematics*, **5(2)**, 185-195, 2010.

Bhatia, R.: Modulus of continuity of the operator absolute value, *Indian Journal of Pure and Applied Mathematics,* **41**, 99-111, 2010.

Bhatia, R. and Sano, T.: Positivity and conditional positivity of Loewner matrices, *Positivity*, **14**, 421-430, 2010.

Cao, Yi, Yao, Zizhen, Sarkar, Deepayan, Lawrence, Michael, Sanchez, Gilson J., Parker, Maura H., MacQuarrie, Kyle L., Davison, Jerry, Morgan, Martin T., Ruzzo, Walter L., Gentleman, Robert C., Tapscott, Stephen J.:Genome-wide MyoD Binding in Skeletal Muscle Cells: A Potential for Broad Cellular Reprogramming, *Developmental Cell*, **18 (4)**, 662-674, 2010.

Chatterjee, A.: Asymptotic properties of sample quantiles from a finite population, *Annals of the Institute of Statistical Mathematics*, **63(1)**, 157-179, 2011.

Chaubey, Y.P., Dewan, Isha, and Li, J.: Smooth estimation of survival and density functions for a stationary associated process using Poisson weights, *Statistics and Probability Letters*, **81**, 267-276, 2011.

Chaubey, Y.P. and Dewan, Isha: Smooth estimation of survival and density functions for stationary associated sequences: some recent developments, *Indian Society Agriculture Statistics*, **64**, 261-272, 2010.

Dewan, Isha and Nimbalkar, U.V.: Load sharing systems, *Wiley encyclopedia of Operations Research and Management Science. ed. J. Cochran, 2011 (http://onlinelibrary.wiley.com/book/10.1002/9780470400531)*

Laishram, Shanta, Hare K. and Stoll, T.: Stolarsky's conjecture and the sum of digits of polynomial values, *Proc. of the AMS*, **1**, 239-49, 2011.

Laishram, Shanta, Khanduja, S.K. and Khassa, R.: Some irreducibility results for truncated binomial expansions, *Journal of Number Theory*, **131**, 300-308, 2011.

Nandi, S. and Kundu, D.: Estimating the parameters of Burst-type signals, Statistica Sinica, **20(2)**, 733-746, 2010.

Nandi, S. and Dewan, I.: An EM Algorithm for Estimating the Parameters of Bivariate Weibull Distribution under Random Censoring, *Computational Statistics & Data Analysis*, **54(6)**, 1559-1569, 2010.

Pal, Arup Kumar, and Sundar, S.: Regularity and dimension spectrum of the equivariant spectral triple for the odd dimensional quantum spheres, *J. Noncommutative Geometry*, **4(3)**, 389-439, 2010.

Vishnoi, A., Roy, R., Prasad, H.K, Bhattacharya, A.: Anchor-Based Whole Genome Phylogeny (ABWGP): A Tool for Inferring Evolutionary Relationship among Closely Related Microorganisms, PloS - I, **5(11)**, el4159, Online Version: DOI: 10.1371/journal.pone.0014159, 2010.

Stat-Math Unit, Bangalore

Adhikari, S.D., Ambily, A.A. and Sury, B.: Zero-sum problems with subgroup weights, *Proc. Indian. Acad. Sci.*, **120**, 259-266, 2010.

Athreya, Siva R. and Swart, Jan M.: Survival of contact processes on the hierarchical group, *Probab. Theory Related Fields*, **147(3-4)**, 529-563, 2010.

Athreya, Krishna, Athreya, Siva R. and Iyer, Srikanth: Critical Age Dependent Branching Markov Processes and Their Scaling Limit, *Proceedings of the Indian Academy of Sciences*, **120(3)**, 363-385, 2010.

Bagchi, Sunanda: Main-effect plans orthogonal through the block factor, *Technometrics*, **52(2)**, 243-249, 2010.

Bhat, B.V. Rajarama, Liebscher, Volkmar, Mukherjee, Mithun and Skeide, Michael: The spatial product of Arveson systems is intrinsic, *J. Funct. Anal.* **260(2)**, 566-573, 2011.

Bhat, B.V. Rajarama and Mukherjee, Mithun: Inclusion systems and amalgamated products of product systems, *Infin. Dimens. Anal. Quantum Probab. Relat. Top.*, **13(1)**, 1-26, 2010.

Bhat, B.V. Rajarama, Liebsher, Volkmar and Skeide, Michael: Subsystems of Fock need not be Fock: spatial CP-semigroups, *Proc. Amer. Math. Soc.*, **138(7)**, 2443-2456, 2010.

Biswas, Jishnu and Ravindra, G.V.: Arithmetically Cohen-Macaulay bundles on complete intersection varieties of sufficiently high multidegree, *Math. Zeitschrift*, **265(3)**, 493-509, 2010.

De Bruyn, B., Sahoo, B.K. and Sastry, N.S.N.: Non-abelian representations of the slim dense near hexagons on 81 and 243 points, *J. Algebraic Combin.*, **33(1)**, 127-140, 2011.

Mason, A.W. and Sury, B.: Subgroups of algebraic groups which are clopen in the S-congruence topology, *Journal of Group Theory*, **14**, 1-9, 2011.

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Raja, C.R.E. and Shah, Riddhi: Distal actions and shifted convolution property, *Israel J. Math.*, **177**, 391-412, 2010.

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Physics and Earth Sciences Division

Geological Studies Unit

Bandyopadhyay, S.: Non-marine Triassic Vertebrates of India, *Dinosaurios y paleontología desde América Latina,* J.O. Calvo, J. Porfiri, B. Gonzalez Rigay and D. Dos Santos (eds.), EDIUNC, Editorial de la Universidad Nacional de Cuyo (ISBN 978-950-39-0265-3), Mendoza, Argentina, 33-46, 2011.

Dutta, R., Ghosh, P. and Sengupta D.P.: Estimation of shape change of skull roof in *Benthosuchus sushkini,* a temnospondyl amphibian from the Triassic of Russia, *Numerical methods and Models in Earth Science*, P. Ghosh (ed.), New India Publishing Agency, New Delhi, 81-97, 2011.

Ray, **S.,** Bandyopadhyay, S. and Appana, R.: Bone histology of a kannemeyeriid dicynodont *Wadiasaurus*: palaeobiological implications, *New Aspects of Mesozoic Biodiversity*, Lecture Notes in Earth Science, Vol.-132, S. Bandyopadhyay (ed.),Springer-Verlag, Heidelberg, 73-89, 2010.

Physics and Applied Mathematics Unit

Gangopadhyay, Kausik and Basu, B.: Income and expenditure distribution: A Comparative Analysis, Economics of Order-driven Markets, *New Economic Windows,* F. Abergel, B.K. Chakraborti, A. Chakraborti and M. Mitra (eds.), Springer, 2011.

Biological Sciences Division

Biological Anthropology Unit

Reddy, B.M.: Population structure and genetic perspectives on the Indian fishermen, Chaper 16 (Invited), *Anthropology Today: Trends and Scope of Human Biology*, Special Vol.-6, M.K. Bhasin and C. Sussane (eds.) Anthropologist, 165-181, 2010.

Reddy, B.M., Alexa, P., Dasgupta, S. Sirisha, P.V.S. and Crawford, M.H.: Degree of inbreeding and fluctuating asymmetry in a subdivided caste population of Andhra Pradesh, India, *Research in Physical Anthropology: Essays in Honour of L.S. Penrose*, S.D. Banik (ed.), Unas Letras Industria Editorial, Mirida Yucatan, Mexico, 67-87, 2010.

Karmakar, B. and Kobyliansky, E.: Qualitative and quantitative finger and palmar dermatoglyphics: Sexual dimorphism in the Turkmenian population, *Research in Physical Anthropology: Essays in Honour of L.S. Penrose*, S.D. Banik (ed.), Unas Letras Industria Editorial, Mirida Yucatan, Mexico, 115-145, 2010.

Roy, S.K., Das, B.M. and Kar, S.: Health and health maintenance system of the Dimasa Kacharis of Cachar District, 11 INCAA Occasional Papers, *On Medical Anthropology: India*, A.K. Danda and I. Talwar (eds.), Indian National Confederation and Academy of Anthropologists, Jhargram and Indira Gandhi National Centre for the Arts, New Delhi, 2010.

Social Sciences Division

Economic Research Unit

Bharati, S., Pal, M., Adak, D.K., and Bharati, P.: Ideology of Son Preference in North-East India, *People of Contemporary North-East India*, Tiluttama Baruah (eds.), Pratisruti Publication, Guwahati, 84-97, 2011.

Jain, Neha, Pal, Manoranjan and Gupta, Raj Narayan: Women Empowerment in India, *Gender Deprivation and Empowerment of Women: An Indian Perspective – Concepts, Issues and Challenges*, U.K. De and B. Ghosh (eds.), Lap Lambert Academic Publishing & Co., Germany, 11-44, 2011.

Maiti, Pulakesh**,** Ghosh, J.K. and Bera, Anil**:** Indian Statistical Institute - Numbers and Beyond (1931-1947) in Project of History of Indian science, Philosophy and Culture (PHISPC), Vol.-XV(4), *Science and Modern India: An Institutional History,* C - 1784-1947(Chapter-33),1013-1056.

Mitra, Manipushpak, Abergel, Frederic, Chakrabarti, Bikas, K., and Chakraborti, Anirban: Two Agent Allocation Problems and the First Bent, *Econophysics of Order-driven Market,* New Economic Window Series, Springer, Italia, 271–275, 2011.

Mitra, Sandip, Sharma Biswas, Chaiti, Nath, Dilip, C., Pal, Manoranjan and Bhattacharya, Biswanath: The Road Map to Hospitalization: Tackling Health Problem in Rural Meghalaya, *Migration, Health and Development*, S. Lahiri, B. Paswan and K.C. Das (eds.), Rawat Publications, Jaipur, 409-429, 2011.

Pal, Manoranjan and Bharati, Premananda: On Measures of Segregation, *Some Contemporary Issues on Development and Growth Economics*, Arpita Dhar (ed.), Allied Publishers Private Limited, Kolkata, 551-584, 2010.

Shome, S., Pal, M., Adak, D.K. and Bharati, P.*:* Adult Body Mass Index (BMI) in the North East States of India, *People of Contemporary North-East India*, Tiluttama Baruah (ed.), Pratisruti Publication, Guwahati, 9-2, 2011.

Sharma Biswas, Chaiti: Status of Women Empowerment at Household level in India, *A Rural-Urban Comparative Study, Population Gender and Reproductive Health*, F. Ram, Sayeed Unisa and T.V. Sekher (eds.), IIPS, Rawat Publications, Jaipur, 71-90, 2011.

Linguistic Research Unit

Dasgupta, Probal: Between temples and templates: history's claims on the translator, *The Translator as Mediator of Cultures*, Humphrey Tonkin, Maria Esposito (eds.) John Benjamins, Amsterdam, 1-14, 2010.

Dasgupta, Probal: La internacia lingvo kaj la universala gramatiko (Introduction to Noam Chomsky), *Lingvo kaj Menso*, Tr. Edmund Grimley Evans, Universala Esperanto-Asocio, Rotterdam, vii-x. 2010.

Dasgupta, Probal: The Hindi long vowel problem: a substantivist approach, *Problematizing Language Studies: Cultural Theoretical and Applied Perspectives: Essays in Honor of Rama Kant Agnihotri*, S. Imtiaz Hasnain, Shreesh Chaudhary (eds.), Aakar, Delhi, 286-291, 2010.

Dasgupta, Probal: Issues in the description of Bangla, *Annual Review of South Asian Languages and Linguistics 2010*, Rajendra Singh (ed.), De Gruyter Mouton, Berlin/ New York, 137-42, 2010.

Dasgupta, Probal: Some milestones in language and cognition studies, *Language-Cognition Interface: State of the Art*, Ramesh Kumar Mishra, Narayanan Srinivasan (eds.), Lincom Europa, Muenchen, 272-290, 2011.

Dash, Niladri Sekhar: Bhasansher sahayye shabder prakrita artha uddhar kakar upay, *Bhasa Prayukti*, Anupam Basu, Tirthankar Dasgupta and Sibansu Mukhopadhyay (eds.), Society for Natural Language Technology Research, Kolkata, 71-88, 2010.

Planning Unit

Mishra, Debasis: Efficient Iterative Combinatorial Auctions, *Wiley Encyclopedia of Operations Research and Management Science*, John Wiley & Sons Ltd., 2011.

Roy Chowdhury, Prabal: Entry Liberalization, Export Subsidy and R&D, *Some Contemporary Issues in Development and Growth Economics,* A. Dhar (ed.), Allied Publishers Pvt. Ltd., 444-463, 2010.

Roy Chowdhury, Prabal: Edgewworth Market Games: Price-taking and Efficiency, *Encyclopedia of Operations Research and Management Science*, John Wiley & Sons Ltd., 2011.

Sen, Arunava: Fair and Loverly: Some Theretical Consideration in the Equitable Allocations of Goods, *Markets and Morals: Ethical Issues in Economics*, Ashok S. Gu (ed.), 91-119, 2011.

Sen, Arunava: Series: PHISPC Centre for Studies in Civilizations, D.P. Chattopadhyay (ed.), 2011.

Population Studies Unit

Bakshi, Sanjeev and Pathak Prasanta: Who Works at Older Ages? The Correlates of Economic Activity and Temporal Changes in Their Effects: Evidences from India, *Ageing: Some Emerging Issues,* K.N.S. Yadava and Alok Kumar (eds.), MANAK, New Delhi, India, 253-278, 2010.

Datta Pranati: Clustering of Nepali Female Migrants in West Bengal, *Gender Deprivation and Empowerment of Women: An Indian Perspective*, U.K.De and B.N. Ghosh (eds.), LAP LAMBERT Academic Publishing, Germany, 267-276, 2011.

Psychology Research Unit

Gupta Rumki and Dhara Jayeta: Nature of Involvement of Self-concept, Academic Achievement and Achievement Motivation of Girls in Comparison to Boys in Urban West Bengal, *Gender Deprivation and Empowerment of Women, an Indian Perspective: Concepts, Issues and Challenges*, Utpal Kumar De and Bhola Nath Ghosh (eds.), LAP LAMBERT Academic Publishing, GmbH & Co. KG, Saarbrucken, Deutschland, Germany, 255–266, 2011.

Sociogical Research Unit

Ramachandran, V.K. and Rawal, Vikas: Impact of Globalization and Liberalization on India's Agrarian Economy, *Globalization and Labour in China and India*, Paul Bowles and John Harriss (eds.), Palgrave Macmillan, UK, 2010.

Swaminathan, Madhura: Population and Food Security, *Handbook of Population and Development*, A.K. Shiva Kumar, Pradeep Panda and Rajani R. Ved (eds.), Oxford University Press, 50-56, 2010.

Ghosh, Bholanath: Nagarik Samaj Andolon, *Bharater Samajik Andolon*, Krishnadas Chattopadhya and Aniruddha Chowdhury (eds.), Levant Books, Kolkata, 238-243, 2010.

De, Utpal and Ghosh, Bholanath: Empowerment of Rural Women in Backward Region of India: A comparative study of Jharkhand, Tripura and Meghalaya, *Gender Deprivation and Empowerment of women: An Indian perspective*, U.K. De and B.N. Ghosh (eds.), Lap Lambert Academic Publishing GmbH & Co. KG, Dudweiler Landstr, 99, 66123, Saarbrucken, 111-146, 2011.

Bhattacharya, Asmita and Ghosh, Bholanath: Women in Information Communications Technology (ICT): Opportunity and Constraint, *Gender Deprivation and Empowerment of Women: An Indian Perspective*, U.K. De and B.N. Ghosh (eds.), Lap Lambert Academic Publishing GmbH & Co. KG, Dudweiler Landstr, 99, 66123, Saarbrucken, 277-289, 2011.

Shome, Suparna, Pal, Manoranjan, Adak, Dipak and Bharati, Premananda: Adult Body Mass Index (BMI) in the North East States of India, *People of Contemporary North East India*, Tiluttoma Baruah (ed.), Pratishruti Publication, Guwahati, 9-25, 2011.

Bharati, Susmita, Pal, Manoranjan, Adak, Dipak and Bharati, Premananda: Ideology of son preference in north east India, *People of Contemporary North East India*, Tiluttoma Baruah (ed.), Pratishruti Publication, Guwahati, 84-97, 2011.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Delhi

Neogy, S.K. and Das, A.K.: Generalized Monotone Maps and Complementarity Problems, *Recent Contributions in Nonconvex Optimization from India*, S.K. Mishra (ed.), Springer Optimization and Its Applications, Vol.-50, 27-44, 2011.

Chakravorty, Rina: Environment Issues as I see it - An Indian Perspective, *Environmental Protection and Sustainable Development*, Bani Dey and Sandhya Gihar (eds.), Wisdom Publications, Delhi, 213-225, 2010.

SQC & OR Unit, Kolkata

Banerjee, I. and Das, P.: Evolutionary Multi-objective Bacterial Swarm Optimization (MOBSO), *A Hybrid Approach*, LNCS, Vol.-6457, K. Deb et al.(eds.), Springer-Verlag, Berlin, Heidelberg, 568–572, 2010.

Center for Soft Computing Research: A National Facility

Maji, P. and Pal S.K.: Rough-Fuzzy Clustering Algorithm for Segmentation and Brain MR Images, *Rough Fuzzy Image Analysis: Foundations and Methodologies*, S.K. Pal and J.F. Peters (eds.), Chapman & Hall /CRC Mathematical and Computational Imaging Sciences Series, 2.1–2.21, 2010.

Peters, J.F. and Pal S.K.: Cantor, Fuzzy, Near and Rough Sets in Image Analysis, *Rough Fuzzy Image Analysis: Foundations and Methodologies*, S.K. Pal and J.F. Peters (eds.), Chapman & Hall /CRC Mathematical and Computational Imaging Sciences Series, 1.1–1.15, 2010.

Sen, D. and Pal S.K.: Image Thresholding using Generalized Rough Sets, *Rough Fuzzy Image Analysis: Foundations and Methodologies*, S.K. Pal and J.F. Peters (eds.), Chapman & Hall /CRC Mathematical and Computational Imaging Sciences Series, 3.1–3.29, 2010.

7. VISITING SCIENTISTS

A number of distinguished scientists from India and abroad participated in the research, training and other scientific activities of the Institute during the year. Some of them came to the Institute on invitation and spent fairly long periods in the Institute to assist in the regular research and teaching programmes, while others came for short periods and gave lectures and seminars. Most of them were available for consultation by the faculty members of the Institute. Names of the visiting scientists are given below.

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Asanuma, T., University of Toyama, February 15-March 03, 2011.

Basu, Samik, Department of Mathematical Sciences, Universitetspark 5, Copenhagen, Denmark, July 06-August 25, 2010.

Dey, Arijit, Indian Institute of Technology, Madras, December 23-30, 2010.

Ganguly, Satadal, Tata Institute of Fundamental Research, Mumbai, January 01-April 30, 2011.

Krishnapur, Manjunath, Indian Institute of Science, Bangalore, December 28, 2010-January 01, 2011.

Majumder, Satyaki, Department of Mathematical Sciences, The University of Texas at Dallas, USA, July 01-December 09, 2010.

Marjit, Sugata, Director, Centre for Studies in Social Sciences-Kolkata, Reserve Bank of India Professor of Industrial Economics, November 16-26, 2010.

Onoda, N., University of Fukui, September 08-28, 2010.

Ray, Swagato K., Department of Mathematics & Statistics, Indian Institute of Technology, Kanpur, July 01-31, 2010.

Sen, Suparna, Indian Institute of Science, Bangalore, January 01-March 31, 2011.

Singh, Rajesh, Pratap, Indian Institute of Technology, Guwahati, July 20, 2010-March 31, 2011.

Wright, David, Washington University, August 14-19, 2010.

Stat-Math Unit, Delhi

Bendre, Sushama, North-Eastern Hill University, Shillong, January 3-February 2, 2010.

Bhattacharyya, Tirthankar, Indian Institute of Sciences, Bangalore, October 30-31, 2010.

Chakrabarty, Arijit, Indian Institute of Science, Bengaluru, January 3, 2011-March 31, 2011.

Chakrabarty, Arijit, Indian Institute of Science, Bengaluru, August 21-September 1, 2010.

Chakraborty, Partha Sarathi, Institute of Mathematical Sciences, Chennai, August 23-29, 2010.

Colletti, Cristian, Universidade Federal do ABC, Brazil, October 18-November 18, 2010.

Doosti, Hassan, Teacher Training University, Tehran, Iran, March 9-March 31, 2011.

Ferreira, Eva, University del Paris Vasco, Spain, January 4-7, 2011.

Karandikar, Rajeeva, Chennai Mathematical Institute, Siruseri, December 4-8, 2010.

Kattumannil, S.K., University of Hyderabad, Hyderabad, June 28-July 3, 2010.

Krishnan, Sivarama, Indian Institute of Technology, Mumbai, July 4-16, 2010.

Lal, Arvind K., Indian Institute of Technology, Kanpur, July 16-23, 2010.

Mulherkar, Jaideep, Dhirubhai Ambani Institute of Information and Communication, Gandhinagar, Gujrat, May 8–July 20, 2010.

Manjunath, B.G., University of Siegen, Germany, November 15-March 31, 2011.

Murty, Ram, Queen's University, Canada, February 16-23, 2011.

Pati, Sukanata, Indian Institute of Technology, Kanpur, July 16-23, 2010.

Ravinder, Himachal Pradesh University, Shimla, January 5-February 2, 2011.

Sharma, Rajesh, Himachal Pradesh University, Shimla, January 5-February 2, 2011.

Shukla, Ashutosh, Banaras Hindu University, Varanasi, December 13, 2010-March 31, 2011.

Stute, Winfried, University of Giessen, Germany, January 4-7, 2011.

Tripathi, Manas Ranjan, Indian Institute of Technology, Kharagpur, April 01-August 6, 2010.

Verma, D.N., Tata Institute of Fundamental Research, Mumbai, March 16-20, 2011.

Stat-Math Unit, Bangalore

Belavkin, V.P., University of Nottingham, United Kingdom, January 16-27, 2011.

Belton, Alexander, Lancaster University, United Kingdom, January 12-26, 2011.

Borghesi, Simone, Universita degli Studi di Milano-Bicocca, Milano, Italy, March 18-31, 2011.

Borkar, Vivek, Tata Institute of Fundamental Research, Mumbai, June 7-11, 2010.

Kulkarni, Manisha, Poornaprajna Institute of Scientific Research, Bangalore, December 1, 2010-March 31, 2011.

Krishnamoorthy, Srilakshmi, Sheffield University, UK, October 1–December 31, 2010.

Lalithambigai, Madurai Kamaraj University, Madurai, June 25-30, 2010.

Lindsay, Martin J., University of Lancaster, UK, April 11-17, 2010.

Visiting Scientists

Margetts, Oliver, Lancaster University, UK, September 01-December 16, 2010.

Marianna, Bolla, Budapest University of Technology and Economics, January 4-5, 2011.

Munshi, Ritabrata, Tata Institute of Fundamental Research, Mumbai, October 4-November 30, 2010.

Nair, Arvind N., Tata Institute of Fundamental Research, Mumbai, January 23-30, 2011.

Rao, B.V., Chennai Mathematical Institute, Chennai, March 27-30, 2011.

Ravichandran, Mohan, Sabanci University, Istanbul, Turkey, January 23-February 19, 2011.

Sainudiin, Raazesh, University of Canterbury, New Zealand, September 14-December 18, 2010.

Shah, Riddhi, Jawaharlal Nehru University, New Delhi, July 13-17, 2010.

Skeide, Michael, Universita degli Studi del Molise, Italy, April 22–September 31, 2010.

Srinivasan, R., Chennai Mathematical Institute, Chennai, May 10-June 4, 2010.

Vavilov, N., St. Petersburg State University, February 16-18, 2011.

Yuri, Bilu, University of Bordeaux, France, August 1-6, 2010.

Applied Statistics Division

Applied Statistics Unit

Bandyopadhyay, Tathagata, Indian Institute of Management, Ahmedabad, January 20-27, 2011.

Baris Suruca, Middle East Technical University, Ankara, Turkey, February 6-19, 2011.

Basak, Prasanta, Department of Mathematics & Statistics, Pennsylvania State University, Altoona, USA, June 1-August 31, 2010.

Borissov, Yuri, Institute of Mathematics and Informatics, Bulgarian Academy of Science, Bulgaria, December 6-16, 2010.

Choudhury, Ashish, School of Computing & Electrical Engineering, Indian Institute of Technology, Mandi, Himachal Pradesh, September 1, 2010-March 31, 2011.

Das, Prem Laxman, C.R. Rao Advanced Institute of Mathematics, Statistics and Computer Science, Hyderabad, November 10-24, 2010.

Halder, Sibsankar, Motorola, Sunnyvale, USA, January 10-March 31, 2011.

Kavut, Selcuk, Gebze Institute of Technology, Turkey, September 1-November 30, 2010.

Kunio Shimizu, Keio University, Tokyo, Japan, December 21-23, 2010.

Raha, Soumyendu, Supercomputer Education and Research Center, Indian Institute of Science, Bangalore, December 15-22, 2010.

Sen, Sandeep, Deparrtment of Computer Science and Engineering, Indian Institute of Technology, Delhi, December 5-19, 2010.

Sungsu Kim, Daegu University, Korea, December 10, 2010-January 20, 2011.

Bayesian and Interdisciplinary Research Unit

Basak, Indrani, Pennsylvania State University, Altoona, USA, June 14-April 15, 2010.

Behera, Narayan, Indian Institute of Science, Bangalore, India, January 17–March 31, 2011.

Dass, Sarat C., Michigan State University, East Lansing, USA, April 1-May 10, 2010.

Datta, Gauri Sankar, University of Georgia, Athens, USA, December 16, 2010–January 15, 2011.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit

Augustine, John E., Nanyang Technological University, Singapore, December 1-4, 2010.

Bandyopadhyaya, Subir, University of Windsor, Canada, October 5, 2010-January 31, 2011.

Banerjee, Nilanjan, IBM Research India, March 30, 2011.

Banerjee, Shibaji, Department of Computer Science, University of Bristol, United Kingdom, December 15, 2010–January 14, 2011.

Basu, Arnab, Indian Institute of Management Bangalore, February 7–March 8, 2011.

Chandran, Sunil L, Indian Institute of Science, Bangalore, July 01-10, 2010.

Das, Kinkar C., Sungkyunkwan University, Department of Mathematics, Korea, January 13-February 16, 2011.

Dhar, Shubhankar, San Jose State University, December 13-27, 2010.

Govindarajan, Sathish, Indian Institute Science, Bangalore. June 26 – July 2, 2010

Gupta, Bidut, Department of Computer Science, Southern Illinois University Carbondale Carbondale, IL 62901, USA, December 15, 2010–January 12, 2011.

Laskar, Renu, Clemson University, July 27-30, 2010.

Majumdar, Shikharesh, Carleton University, Ottawa, Canada, December 1-3, 2010.

Mishra, Prabhat, University of Florida, August 10-12, 2010.

Paul, Himadri Sekhar, ISIP Ltd, March 9, 2011.

Visiting Scientists

Roy, Sasanka, Chennai Mathematical Institute, Chennai, December 5-12, 2010.

Saidur, Rahaman Md., Bangladesh University Engineering and Technology (BUET), Dhaka, February 21-23, 2011.

Saurabh, Saket, The Institute of Mathematical Sciences, Chennai, July 12-15, 2010.

Computer Vision and Pattern Recognition Unit

Majumder, Prasenjit, Dhirubhai Ambani Institute of Information and Communication Technology, Gandhinagar, May 01–July31, 2010.

Ragot, Nicolas, Université François Rabelais Tours, France, February 19-27, 2011.

Documentation, Research and Training Centre

Asundi, A.Y., University of Bangalore, October 05, 2010–January 31, 2011.

Bhat, P.G., Pluma Knowledge Solutions (P) Ltd., Bangalore, October 25-November 03, 2010.

Chidamparam, Department of Computer Science, Peoples Education Society Institute of Technology, Bangalore, March 11-31, 2011.

Geetha, Venkataswamy, Department of English Language, Bangalore University, December 01, 2010-January 31, 2011.

Irene, Wormell, Information Management, Swedish School of Library and Information Science, University of Gothenburg, Sweden, December 6-19, 2010.

Kavi, Mahesh, Department of Computer Science, Peoples Education Society Institute of Technology, Bangalore, March 11-31, 2011.

Peter, Ingwersen, Department of Information Studies, The Royal School of Library and Information Science, Denmark, December 6-19, 2010.

Saiful, Amin, Edutech India Pvt. Ltd., Bangalore, March 10-31, 2011.

Electronics and Communication Sciences Unit

Chung, I-Fang, Institute of Biomedical Informatics, National Yang-Ming University, Taipei, Taiwan (Republic of China), January 07-30, 2011.

Thompson, Renaldo, School of Digital Arts, University of Guanajuato, Mexico, February 05-22, 2011.

Machine Intelligence Unit

Alfredo, A. Arias, Centro de Investogacopm u de Estudios Avanzados del IPN (CINVESTAV-IPN), Mexico, August 07-28, 2010.

Antonio, J. Lopez, Centro de Investogacopm u de Estudios Avanzados del IPN (CINVESTAV-IPN), Mexico, August 07-21, 2010.

Pawan, Lingras, Saint Mary's University, Canada, February 01-20, 2011.

Roberto, Baragona, University of Rome, Italy, February 01-28, 2011.

Systems Science and Informatics Unit

Banerjee, A., National Institute of Health, Bethesda, Maryland, USA, March 14-16, 2011.

Beira, E., Engineering Design and Advanced Manufacturing, MIT Portugal Program School of engineering, Portugal, February 15-16, 2011.

Cousty, J., Université Paris-Est, ESIEE, France, October 15-27, 2010.

Dasgupta, D., Department of Computer Science, University of Memphis, USA, December 16–17, 2010.

Iyengar, S.S., Department of Computer Science, University Louisiana State, USA, December 20, 2010–January 14, 2011.

Kiselman, C.O., Department of Mathematics, Uppsala University, Sweden, August 30-September 04, 2010.

Krishnamurthy, N., Chennai Mathematical Institute, Chennai, March 30–31, 2011.

Najman, L., Université Paris-Est, ESIEE, France, October 15–27, 2010.

Pina, P., Universidade Técnica de Lisboa, Portugal, October 22–27, 2010.

Serra, J., Université Paris-Est, ESIEE, France. October 15–27, 2010.

Bhalla, U.S., National Centre for Biological Sciences, Bangalore, March 14, 2011.

Deriche, R., INRIA, Sophia Antipolis, France, March 15, 2011.

Jain, N., National Brain research Centre, Manesar, Haryana. March 15, 2011.

John, J. P., National Institute of Mental health and Neuro Sciences, Bangalore, March 14, 2011.

Krishnamurthy, N., Chennai Mathematical Institute, Chennai, March 30-31, 2011.

Kumar, V. M., The Sree Chitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapuram, March 15, 2011.

Rao, C.B., Indira Gandhi Centre for Atomic Research, Kalpakkam, October 25, 2010.

Rao, N.R., Indian Institute of Space Science and Technology, Trivandrum, October 26, 2010.

Ranjan, U., Philips Healthcare, Bangalore, October 26, 2010.

Singh, R., Indian Research Lab, IBM, Delhi, March 14, 2011.

Visiting Scientists

Sripati, A., Indian Institute of Science, Bangalore, March 15, 2011.

Vaidya, V. A., Tata Institute of Fundamental Research, Mumbai, March 14, 2011.

Physics and Earth Sciences Division

Geological Studies Unit

Christian F. Kammerer, American Museum of Natural History, New York, March 19-26, 2011.

Davidson, Stephani, University of Aberdeen, UK, January 02-16, 2011.

Hartley, Adrian, University of Aberdeen, UK, January 02-16, 2011.

Van Loon, A.J., Geological Institute, Adam Mickiewicz University, Poland, January, 6-27, 2011.

Weissman, Gary, University of New Mexico, USA, January 02-16, 2011.

Physics and Applied Mathematics Unit

Chakrabarti, A., Department of Mathematics, Indian Institute of Sciences, Bangalore, June 21–July 2, 2010.

Bhowmik, N.G., Illinois State Water Survey, University of Illinois at Urbana-Champaign, USA, October 22–Novermber 15, 2010.

Demissie Mike, Illinois State Water Survey, University of Illinois at Urbana-Champaign, USA, October 31– Novermber 6, 2010.

Lahti, Pekka, Department of Physics, University of Turku, Finland, December 12–15, 2010.

Graf, W.H., A.L. Ecole Polytechnique Federale, Laboratoire D'Hydraulique, Lausanne, Switzerland, December 22, 2010.

Sarkar, Sujit, Poornaprajna Institute of Scientific Research, Bangalore, January 11–14, 2011.

Rahaman, Ramij, University of Bergen, Norway, January 17–February 7, 2011.

Purkait, Barendra, Geological Survey of India, Kolkata, February 01– March 31, 2011.

Paul, Suvadip, Tripura, February 01–March 31, 2011.

Sarkar, Swarnendu, Department of Physics & Astrophysics, Delhi University, March 09–11, 2011.

Biological Sciences Division

Agricultural and Ecological Research Unit

Bhattacharyya, P., Department of Renewable Resources, University of Wyoming, Laramie, Wyoming, USA, January 28-February 11, 2011.

Mukhopadhyay, G., Derozio College, Kolkata, January 13-March 31, 2011.

Sarkar, S., Department of Life Science and Biotechnology, Jadavpur University, Kolkata, January 01-March 31, 2011.

Biological Anthropology Unit

Adak, D.K., Anthropological Survey of India, Kolkata February 14-March 31, 2011.

Mozumdar, A., Adjunct Faculty, Department of Health, Nutrition and Exercise Sciences, North Dakota State University, Fargo, ND, USA, November 01, 2010-March 31, 2011.

Human Genetics Unit

Chakraborty T., Birmingham Medical College and Hospital, UK, November 01, 2010-March 31, 2011.

Goswami, K., MGIMS, Sevagram, December 01-31, 2011.

Saha, S., BIN, Kolkata, December 01-31, 2011.

Social Sciences Division

Economic Research Unit

Barari Mitra, Mahua, Department of Economics, Missouri State University, Springfield, MO 65897, USA, March 1–April 30, 2011.

Chakraborty, Bikas K., Centre for Applied Mathematics & Computational Science, Saha Institute of Nuclear Physics, Kolkara, August, 2010-March 31, 2011.

Ghosh, Arghya, School of Economics, Australian School of Business, University of New South Wales, Sydney, NSW 2052, Australia, January 13-27, 2011.

Mutuswami, Suresh, Department of Economics, University of Leicester, University Road, Leicester, LE1 7RH, UK, January 3–10, 2011.

Sengupta, Sarbajit, Department of Economics, Visva Bharati, Santiniketan, January 1-May 31, 2010.

Sinha, Uday Bhanu, Department of Economics, Delhi School of Economics, University of Delhi, February 7-21, 2011.

Linguistic Research Unit

Bayer, Josef, Department of Linguistics, University of Konstanz, Germany, January 3–17, 2011.

Jha, Girish Nath, Jawaharlal Nehru University, India, January 24, 2011.

Sahay, Poonam, Department of English, Ranchi University, Jharkhand, January 18, 2011.

Planning Unit

Afridi, Farzana, Syracuse University, USA, April 01-June 30, 2010.

Alonso, Irasema, Yale University, USA, December 21-28, 2010.

Ambec, Stefan, Toulouse, France, March 7–19, 2011.

Bishnu, Monisankar, Deparment of Economics, Iowa State University, USA, August 31, 2010-March 31, 2011.

Chatterjee, Chiranjan, Carnegi-Mellon University, USA, December 28-29, 2010.

Chatterjee, Shurojit, Singapore Management University, Singapore, September 30-October 9, 2010.

Dam, Kanishka, Instituto Tecnologico Autonomo de Mexico, Mexico, January 06–09, 2011.

Dmitrov, Dinko, Saarland University, Germany, March 01-19, 2011.

Dutta, Bhaskar, Warwick University, U.K., July 01, 2010 - June 30, 2011, Distinguished Visiting Professor.

Dziubinski, Marcin, Institute of Informatics, Faculty of Mathematics, Warsaw University, Poland, December 16-31, 2010.

Iversen, Vegard, University of East Anglia, UK, September 01, 2010-March 31, 2011.

Khera, Reetika, Centre for Development Economics, Delhi School of Economics, Delhi, April 01-July 31, 2010.

Kubo, Kensuke, Department of Agricultural & Resource Economics, University of California. USA, October 01, 2010-March 31, 2011.

Majumdar, Dipjyoti, Concordia University, Montreal, August 16–30, 2010.

Mathur, Raj, New Delhi, July 01–November, 2010.

Rajaraman, Indira, National Institute of Public Finance and Policy, India, February 01-March 31, 2011.

Ramaekers, Eve, Center for Operations research and Econometrics, University of Louvain, Belgium, March 01-13, 2011.

Ray, Debraj, New York University, USA, April 01-30, 2010.

Shalabh, Department of Mathematics and Statistics, Indian Institute of Technology, Kanpur, November 11-12, 2010.

Singh, Gurbachan, School of International Studies, Jawaharlal Nehru University, India, April 31– May 13, 2010.

Sprumont, Yves, University de Montreal, Canada, August 01, 2010-June 30, 2011.

Tarafdar, Suchismita, Department of Economics, W.P. Carey School of Business, Arizona State University, USA, July 20, 2010–March 31, 2011.

Tiwari, Amaresh, Maastircht University, The Netherlands, April 01-30, 2010.

Wadhwa, Wilima, Centre de Formation Professionnelle en Alsace (SERFA), January 01–March 31, 2011.

Psychology Research Unit

Chakrabartty, S.N., Indian Maritime University, Kolkata, December 7, 2010.

Chatterjee, G., Harvard University, USA, January 8, 2011.

Fairbairn, Gavin J., Leeds Metropolitan University, UK, July 8, 2010.

Kaur, Gurupreet, Defence Institute of Psychological Research, Defence Research and Development Organisation, Delhi, March 2, 2011.

Majumdar, S.K., Majumdar Institute of History, Sociology and Philosophy of Science and Health Sciences, Kolkata, March 23, 2011.

Sociological Research Unit

Dixit, Anita, Queen Elizabeth House, Oxford, UK, December 01, 2010-March 31, 2011.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Chennai

Parthasarathy, T., Chennai Mathematical Society, Chennai (under Indian National Science Academy), April 31, 2010-March 31, 2011.

SQC & OR Unit, Hyderabad

Parthasarathy, T., Chennai Mathematical Society, Chennai, March 19-21, 2011.

SQC & OR Unit, Kolkata

Singpurwalla, Nozer D., Washington University, USA, February 8-9, 2011.

Mukhopadhyay, Chiranjit, Indian Institute of Science, Bangalore, February 8-17, 2011.

Center for Soft Computing Research: A National Facility

Nakashima, Tomuharu, Osaka Prefecture University, Japan, January 11-25, 2011.

8. HONOURS AND AWARDS

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Bose, Arup
Selected: Member of the Sectional Committee for Mathematical Sciences,
Indian National Science Academy.

Stat-Math Unit, Delhi

Bhatia, R.
Elected: Fellow of Academy of Sciences for the Developing World.

Chatterjee, Arindam
Awarded: Microsoft Young Faculty Award, 2010.

Laishram, Shanta
Awarded: Microsoft Young Faculty Award, 2010.

Applied Statistics Division

Applied Statistics Unit

SenGupta, Ashis
Elected: Fellow, National Academy of Sciences, Allahabad, India.
Re-appointed: Advisor, Scientific Advisory Board, Institute of Statistical Mathematics, Tokyo, Japan.
Appointed: Citizen Ambassador, American Statistical Association, Delegation to Beijing, Xian and Shanghai, China, 2011.
Elected: President, Mathematical Sciences Section, Indian Science Congress Association, 2011.

Computer and Communication Sciences Division

Computer Vision and Pattern Recognition Unit

Chaudhuri, B.B.
Awarded: J.C. Bose Fellowship, 2010.

Electronics and Communication Sciences Unit

Pal, Nikhil R.
Elected: Fellow of the Indian National Science Academy.
Appointed: IEEE Computational Intelligence Society Distinguished Lecturer by the AdCom of the IEEE Computational Intelligence Society.

Machine Intelligence Unit

Bandyopadhyay, S.
Awarded: Shanti Swarup Bhatnagar Prize in Engineering Sciences, CSIR, New Delhi, 2010.
Elected: Fellow of National Academy of Sciences India, Allahabad, 2010.
Awarded: Humboldt Fellowship for Experienced Researchers at Max Planck Institute for Informatics, Saarbrucken and University of Heidelberg, Germany, 2010-2011.

Kundu, Malay K.
Elected: Fellow of the International Association for Pattern Recognition (IAPR), 2010.

Systems Science and Informatics Unit

Majumdar K.K.
Elected: Senior Member of IEEE, USA, 2010.

Sagar B.S.D.
Elected: Fellow of Indian Geophysical Union, 2011.
Selected: Georges Matheron Lecturer, International Association for Mathematical Geosciences USA, 2011.

Physics and Earth Sciences Division

Geological Studies Unit

Bandyopadhya, Saswati

Awarded: Sharda Chandra Gold Medal, Palaeontological Society of India, Lucknow, 2010.

Social Sciences Division

Economic Research Unit

Chakravarty, Satya R.
Awarded: Fellow of Human Development and Capability Association, USA.

Mitra, Sandip
Selected: Member of the Advisory Committee of Vice Chancellor, Central University, Orissa.

Planning Unit

Mukhopadhyay, Abhiroop
Awarded: Sir Ratan Tata Senior Fellowship (at the Associate Professor Level), Institute of Economic Growth, 2010–2011.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Bangalore

Acharya, U.H.
Selected: Team leader for Southern Zone in Rajiv Gandhi National Quality Award Assessments, 2010.

SQC & OR Unit, Hyderabad

Murthy, G.S.R.
Selected: Member of the Rajiv Gandhi National Quality Award Evaluation Committee, Western Zone.

Center for Soft Computing research: A National Facility

Ray, S.S.
Awarded: Microsoft Young Faculty Award, 2011.

9. EDITORIAL AND OTHER SCIENTIFIC ASSIGNMENTS

EDITORIAL ASSIGNMENTS

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Bose, Arup (Associate Editor): Statistical Methodology; (Associate Editor): Statistics and Probability Letters; (Associate Editor): IMS Collection, Institute of Mathematical Statistics.

Chaudhuri, Probal (Editor): International Statistical Review; (Associate Editor): Journal of the American Statistical Association, Statistica Sinica and Advances in Statistical Analysis.

Stat-Math Unit, Delhi

Bandyopadhyay, Antar (Revision Editor): Book on 'Measure Theory and Probability' by A.K. Basu, PHI Learning.

Bapat, R.B. (Advisory Editor): Electronic Journal of Linear Algebra; **(**Associate Member): Bulletin of Kerala Mathematical Association.

Bhatia, R. (Chief Editor): Proceedings of International Congress of Mathematicians 2010, Hyderabad; (Managing Editor): Text and Readings in Mathematics, Hindustan Book Agency; (Editor): Culture and History of Mathematics, Hindustan Book Agency.

Bhatt, Abhay Gopal (Co-editor): Sankhya.

Dewan, Isha (Associate Editor): Computational Statistics and Data Analysis and Journal of Indian Statistical Association.

Pal, Arup (Co-editor): Proceedings of International Congress of Mathematicians 2010.

Stat-Math Unit, Bangalore

Bhat, B.V. Rajarama (Member, Council of Editors): Resonance, Journal of Science Education.

Ramasubramanian, S. (Co-editor): Sankhya Series A, Volume 72, 2010.

Applied Statistics Division

Applied Statistics Unit

Biswas, A. (Associate Editor): Sequential Analysis, Taylor and Francis; Communications in Statistics, Taylor and Francis.

Dewanji, A. (Associate Editor): Calcutta Statistical Association Bulletin.

Editorial and other Assignments
SenGupta, A. (Editor-in-Chief): Environmental and Ecological Statistics, Springer, USA; (Editor): Scientiae Mathematicae Japonicae, Japanese Association of Mathematical Sciences, Japan; (Associate Editor): Journal of Statistics and Applications (USA); (Co-editor): Sankhya, Series B.

Bayesian Interdisciplinary Research Unit

Basu, Ayanendranath (Editor): Sankhya Series B; (Associate Editor): Journal of Statistical Inference and Planning.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit

Bhattacharya, B.B. (Editor) Journal of Electronic Testing: Theory and Applications.

Sur-Kolay, Susmita (Associate Editor): IEEE Transactions on VLSI Systems.

Computer Vision and Pattern Recognition Unit

Chaudhuri, B.B. (Associate Editor): International Journal of Pattern Recognition and Artificial Intelligence; VIVEK; International Journal of Computer Vision; International Journal of Document Analysis; IETE Technical Review; Electronic Letters on Computer Vision and Image Analysis.

Pal, U. (Associate Editor): Electronic Journal on Computer Vision and Image Analysis, CVC Press; International Journal of Computer, Mathematical Sciences and Applications.

Mitra, Mandar (Guest Editor): ACM Transactions on Asian Language Information Processing (Special issue on Indian language Information Retrieval), Vol.-9, No.-3 & 4, 2010.

Documentation, Research and Training Centre

Ravichandra Rao I.K. (Chief-Editor): COLLNET Journal of Scientometrics and Informetrics Management, Taru Publications, New Delhi, Vol-5, 2011; (Editor): SRELS Journal of Information Management, Vol.-48, No.-1, 2011.

Electronics and Communication Sciences Unit

Pal, Nikhil R. (Editor-in-Chief): IEEE Transactions on Fuzzy Systems, 2010, IEEE, USA; (Associate Editor): IEEE Transactions Systems, Man and Cybernetics, IEEE, USA; (Associate Editor): International Journal of Approximate Reasoning, Elsevier, Netherlands; (Member, Advisory Committee): International Journal of Intelligent Computing in Medical Sciences and Image Processing, TSI Press, USA; (Associate Editor): Fuzzy Information and Engineering, An International Journal, Springer; (Member, Editorial Advisory Board): International Journal of Neural Systems, World Scientific.

Machine Intelligence Unit

Mitra, S. (Associate Editor): IEEE/ACM Trans. on Computational Biology and Bioinformatics (IEEE TCBB); Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery (WIRE DMKD); Neurocomputing; Journal of Computational Intelligence in Bioinformatics (JCIB).

Systems Science and Informatics Unit

Sagar B.S.D. (Editor): Discrete Dynamics in Nature and Society (a multidisciplinary research and review Journal), Hindawi Publishers, USA; (Guest Editor): International Journal of Remote Sensing, Taylor & Francis Publishers, UK; (Editor): ICTACT Journal on Image and Video Processing.

Physics and Earth Sciences Division

Geological Studies Unit

Ghosh, P. (Editor): Numerical Method and Models in Earth Science, New India Publishing Agency, New Delhi.

Saha, Dilip (Editor): Indian Journal of Geology.

Physics and Applied Mathematics Unit

Mazumder, B.S. (Editor, with N.G. Bhowmik): Ecological Health of River-2010 (Indo-US Science and Technology Forum).

Mandal, B.N. (Editor-in-Chief): OPSEARCH, Springer.

Biological Sciences Division

Biological and Anthropology Unit

Mukhopadhyay, B. (Consulting Editor): Collegium Antropologicum, 2010; Journal of Croatian Anthropological Association; (Associate Editor): Journal of Indian Anthropological Society 2010; Official publication of Indian Anthropological Society.

Social Sciences Division

Linguistic Research Unit

Dasgupta, Probal (Editor, with Humphrey Tonkin): Language Problems and Language Planning, Vol.-34, No.-2 & 3, 2010, Vol.-35, No.-1, 2011; (Editor): International Journal of Mind, Brain and Cognition, Vol.-1 No.-1, Bahri Publications, 2010; (Guest Editor): Alochonachakro: Bhashatatto Bishesh Sankhya, Vol.-29, 2010.

Editorial and other Assignments
Dash, Niladri Sekhar (Review Board Member): GLOSSA: Language Research Center, School of Social and Human Sciences, Universidad del Turabo, Gurabo, Puerto Rico.

Planning Unit

Das, Satya P. (Editor): Indian Growth and Development Review; (Associate Editor): Journal of Economic Behavior and Organization; (Member, Editorial Advisory Board): Trade and Development Review.

Ghate, Chetan (Policy Editor): Indian Growth and Development Review, UK.

Roy Chowdhury, Prabal (Associate Editor): Indian Growth and Development Review.

Ramaswami, Bharat (Co-Editor): Indian Growth and Development Review.

Somanathan, E. (Associate Editor): Environment and Development Economics.

Psychology Research Unit

Dutta Roy, D. (Editor-in-Chief): Psyber News, Vol-1, No.-2 - 4, 2010; Vol.-2, No. 1-2, 2011.

Library, Documentation and Information Science Division

Library, Delhi

Khatri, N.K. (Member, Advisory Board): Gyankosh: The Journal of Library and Information Management, Vol.-1, No.-1, 2010.

Centre for Soft Computing Research: A National Facility

Ghosh, A. (Associate Editor): International Journal of Soft Computing and Bioinformatics.

Pal S. K. (Associate Editor): Pattern Recognition Letters; International Journal of Pattern Recognition & Artificial Intelligence; Applied Intelligence; Information Sciences; Fuzzy Sets and Systems; Fundamenta Informaticae; LNCS Trans. on Rough Sets; International Journal of Computational Intelligence and Applications; IET Image Processing; Journal of Intelligent Information Systems; Proceedings of INSA-A; (Editor-in-Chief): International Journal of Signal Processing; Image Processing and Pattern Recognition; Book Series Editor; Frontiers in Artificial Intelligence and Applications, IOS Press; Holland and Statistical Science and Interdisciplinary Research, World Scientific; (Member, Executive Advisory Editorial Board): IEEE Trans. Fuzzy Systems; International Journal on Image and Graphics; International Journal of Approximate Reasoning; International Journal of Computational Science & Engineering; (Guest Editor): Theoretical Computer Science - C.

SCIENTIFIC ASSIGNMENTS/ACADEMIC VISITS ABROAD

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Barua, R.:
Department of Mathematics, Kyushu University, Japan, February 19-26, 2011.

Basak, Gopal, Krishna:
Department of Mathematics, Hong Kong University of Science and Technology, Hong Kong (SAR), May 25-June 2, 2010.

Bose, Arup:
(1) Department of Economics, University of Cincinnati, May 10—June 18, 2010; (2) Department of Economics, University of Cincinnati, October 01—November 19, 2010; (3) Department of Mathematics, Indiana University-Purdue University Indianapolis, October 25, 2010; (4) Department of Statistics, Indiana University, November 15, 2010.

Chaudhuri, Probal:
(1) University of Economics, June 28-July 2, 2010, Prague, Czech Republic; (2) Oberwolfach, Germany, February 27-March 5, 2011.

Goswami, Debashish:
(1) University of California at Berkeley, USA, January 01-March 31, 2011.

Poddar, Mainak:
(1) Korea Advanced Institute of Science and Technology (KAIST), Korea and Seoul National University, Korea, May-June 2010; (2) Universidad de los Andes, Bogota, January 01-March 31, 2011.

Stat-Math Unit, Delhi

Bandyopadhyay, Antar:
Department of Statistics and Applied Probability, National University of Singapore, Singapore, June 1-30, 2010.

Bapat, R.B.:
(1) Institute of Computer Science of the Polish Academy of Sciences, Warsaw, Poland, May 24-June 19, 2010; (2) Palazzo del Congressi, Pisa, Italy, June 20-25, 2010.

Bhatia, Rajendra:
(1) University of Rome, Italy, June 7-12, 2010; (2) University of Coimbra, Portugal, June 13-18, 2010; (3) Palazzo del Congressi, Pisa, Italy, June 21-25, 2010; (4) The Indo-French Conference on Matrix Information Geometrics, Paris, France, February 22-25, 2011; (5) Ecole Polytechnique, Paris, France, February 27, 2011 to March 4, 2011.

Roy, Rahul:
UFR de Mathematique et Informatique, Toulouse and Universitat Autonoma De Barcelona, May 3-June 16, 2010.

Sarkar, Deepayan:
FAA Technical Center, Atlantic City, USA, August 9-19, 2010.

Editorial and other Assignments

Stat-Math Unit, Bangalore

Athreya, Siva:
(1) Hokkaido University, Japan, August 30–September 4, 2010; (2) University of British Columbia, Vancouver, Canada, January 1-March 31, 2011.

Bhat, B.V. Rajarama:
(1) Chungbuk National University, South Korea, October 11–22, 2010; (2) Institut fur Mathematik und Informatik, Universitat Greifswald, Germany, March 7–18, 2011.

Rao, T.S.S.R.K.:
Department of Mathematics, University of Bologna, Italy, October 1–30, 2010.

Sreekantan, Ramesh:
(1) University of Milano-Biccoca, May, 2010; (2) Universite Paris-Sud 11, Orsay, Cedex, France, June, 2010; (3) Institut Henri Poincare (IHP), Paris, June, 2010; (4) University of Montreal, Canada, December 2, 2010–January 7, 2011.

Applied Statistics Division

Applied Statistics Unit

Biswas, A.:
(1) University of Malaya, Kuala Lumpur, Malaysia, May 2010; (2) University of Bologna, Italy and University of Valladolid, Spain, June, 2010; (3) Chittagong University, December 2010; (4) University of Dhaka, Bangladesh, 26-28 December 2010; (5) University of Birmingham, UK, February-March, 2011.

Dewanji, A.:
Fred Hutchinson Cancer Research Center, Seattle, USA, July-August, 2010.

SenGupta, A.:
(1) University of Malaya, Kuala Lumpur, Malaysia, June, 2011; (2) University of Daegu, Korea, August 2010; (3) Keio University, Japan, August, 2010; (4) Maresias, Brazil, August 8-13, 2010; (5) University of Dhaka, Bangladesh, 26-28 December 2010.

Bayesian Interdisciplinary Research Unit

Basu, Ayanendranath:
(1) University of Economics, Prague, Czech Republic, June 2010; (2) Department of Statistics and Operations Research, Complutense University, Madrid, Spain, November, 2010; (3) Carlos III University, Madrid, Spain, November, 2010; (4) Department of Statistics, University of Warwick, Coventry, UK, December, 2010; (5) Senate House, University of London, UK, December, 2010.

SahaRay, Rita:
(1) Department of Mathematics and Statistics, Missouri University of Science and Technology, Rolla, USA, August 16, 2010-March 31, 2011.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit

Bhattacharya, B.B.:
(1) School of Software, Tsinghua University, Beijing, China, December 4-8, 2010; (2) Asian Test Symposium (ATS), Shanghai, China, November 30-December 3, 2010.

Das, Nabanita:
(1) Biopolis, Singapore, March 22–25, 2011; (2) School of Computing, National University of Singapore, March 22–25, 2011.

Computer Vision and Pattern Recognition Unit

Chaudhuri, B.B.:
(1) Independent University, February 18-23, 2011; (2) United International University, February 18-23, 2011; (3) Bangladesh Computer Council, Dhaka, Bangladesh, February 18-23, 2011.

Garain, U.:
Istanbul Convention & Exhibition Centre (20th International Conference on Pattern Recognition), Istanbul, Turkey, August 23-27, 2010.

Pal, U.:
(1) School of Computing, National University of Singapore, Singapore, June 18-26, 2010; (2) Istanbul Convention & Exhibition Centre (20th International Conference on Pattern Recognition), Istanbul, Turkey, August 21-27, 2010.

Documentation, Research and Training Centre

Krishnamurth M:
United Nations University, Tokyo, Japan, February 10-12, 2011.

Raghavan K.S:
HealthNet Nepal, Kathmandu, Nepal, July 22-26, 2010.

Prasad A.R.D:
(1) Paris, France, Italy, September 1-11, 2010; (2) European Commission, Brussels, January 24-28, 2011 and February 21-25, 2011 (3) Hannover, Germany, March 16-18, 2011.

Madalli, Devika P:
(1) Paris, France, Italy, September 1-11, 2010; (2) Dipartimento Di Ingegneria E Scienza Dell'Informazione, University of Trento, September 26-October 3, 2010.

Electronics and Communication Sciences Unit

Mukherjee, Dipti Prasad:
Department of Radiology, Graduate School of Medicine, Osaka University, Japan, September 27-October 27, 2011.

Editorial and other Assignments
Pal, Nikhil Ranjan:
(1) Bangkok Marriott Resort & Spa (1st International Conference on Computational Systems-Biology and Bioinformatics, CSBio-2010), Bangkok, Thailand, November 3–5, 2010; (2) Cairo University, Cairo, Egypt, 29 November-1 December 2010; (3) Xi'an Jiaotong-Liverpool University; Suzhou, China, August 25-27, 2010. (4) Westfalenhallen, Dortmund, Germany, June 28-July 02, 2010.

Machine Intelligence Unit

Bandyopadhyay, S.:
(1) University of Heidelberg, Germany, September 16-17, 2010; (2) Max Planck Institute for Informatics, Saarbrucken, Germany, April-June, 2010.

Biswas, S.:
(1) International Conference on IEEE International Symposium on Industrial Electronics (ISIE-2010), Bari, Italy, July 4-7, 2010; (2) delivered talk, INRIA, France, July 12, 2010.

Ghosh, A.:
(1) University of Trento, Italy, May 16-June 5, 2010; (2) RWTH Aachen University, Germany, August 30-September 30, 2010; (3) University of Brussels, Belgium, September 8-10, 2010.

Kundu Malay K.:
(1) Istanbul Convention & Exhibition Centre (20th International Conference on Pattern Recognition), Istanbul, Turkey, August 23-26, 2010; (2) 8th International Conference on Wavelet Analysis and Pattern Recognition (ICWAPR 2010), Qingdao, Shandong China, July 10-13, 2010; (3) University of Milan, Italy, February 21, 2011.

Mitra, S.:
IEEE World Congress on Computational Intelligence, Barcelona, Spain, July 18-23, 2010.

Physics and Earth Sciences Division

Geological Studies Unit

Chakraborty, Tapan:
(1) Asian Climate & Tectonics, Utrecht University, Netherlands, April 25-May 1, 2010; (2) European Geosciences General Assembly 2010 (EGU2010), Vienna, Austria, May 2-7, 2010; (3) Imperial College, London, May 8-15, 2010; (4) Laboratoire de Geodynamique de Chaines Alpines (LGCA), University of Joseph Fourier, Grenoble, France, May 17-21, 2010.

Das, S.S.:
Royal Phuket City Hotel (World Congress of Malacology), Phuket, Thailand, July 18-24, 2010.

Mazumder, Rajat:
Curtin University of Technology, Perth, Australia, September 4-21, 2010.

Patrnabis-Deb, S.:
(1) Stanford University, USA, June 01–July 31, 2010; (2) Indiana University, Bloomington, USA, June 01–July 30, 2010; (3) Duluth, Minnesota, USA. June 01–July 31, 2010.

Physics and Applied Mathematics Unit

Ghosh, S.:
(1) University of Metz, France, September 1–November 5, 2010; (2) National Institute for Theoretical Physics in Maitland, South Africa, February 15-March 3, 2011.

Das, P.K.:
Chungbuk National University, Cheongiu, Korea, January 7–13, 2011.

Mazumder, B.S.:
Islamic University of Technology, Bangladesh, December 17–21, 2010.

Pal, S.:
University of Bonn, Germany, September 7, 2010–March 31, 2011.

Biological Sciences Division

Biological Anthropology Unit

Mukhopadhyay, B.:
World Congress on Cardiology, Beijing, China, June 16–19, 2010.

Social Sciences Division

Economic Research Unit

Chakravarty, Satya R.:
Department of Economic of Bar-Illan University, Israel, August 28–September 4, 2010.

Mitra, Manipushpak:
(1) Singapore Management University, Singapore & Department of Economics, Seoul National University, Seoul, Korea, May 19–30, 2010; (2) Department of Economics, University of New South Wales, Australia, December 12–28, 2010.

Mazumdar, Krishna:
Svenska Mässan, The Swedish Exhibition & Congress Centre (XVII ISA World Congress of Sociology), Gothenburg, Sweden, July 12–19, 2010.

Kabiraj, Tarun:
Faculty of Business and Economics, Technische Universitat Dresden, Germany, June 21–30, 2010.

Pal, Manoranjan:
Development Studies in the University, Malaya, Kuala Lumpur, Malaysia, June 8–18, 2010.

Sarkar, Abhirup:
Maulana Abul Kalam Azad Institute of Asian Studies, Kunming, People's Republic of China, October 26–31, 2010.

Editorial and other Assignments

Linguistic Research Unit

Dasgupta, Probal:
(1) La Habana Conference Center, Havana, Cuba, July 17-24, 2010.

Planning Unit

Mishra, Debasis:
University in LERNA, Toulouse School of Economics, France, June 01-30, 2010.

Mukhopadhyay, Abhiroop:
(1) Universidad Carlos III de Madrid, May 01-31, 2010; (2) Asia Research Centre, London School of Economics and Political Science, June 01-July 31, 2010.

Ramaswami, Bharat:
University of British Columbia, March 29–April 06, 2011.

Roy Chowdhury, Prabal:
(1) Singapore Management University, Singapore. April 19-23, 2010; (2) University of Sydney & University of Monash, July 19–01, October 2010; (3) National University of Singapore, March 18–31, 2011.

Sen, Arunava:
(1) School of Economics, Singapore Management University, May 04–18, 2010; (2) State University – Higher School of Economics, Moscow, July 20–24, 2010.

Somanathan, E.:
(1) Department of Economics, University of Namur, May 03-July 02, 2010; (2) Princeton Environmental Institute, Princeton University, USA, September 01-August 31, 2011.

Psychology Research Unit

Ghosh, A:
(1) Harvard University, USA, May 31-June 3, 2010; (2) Culture and Emotion Laboratory, San Francisco State University, USA, June 9-July 15, 2010.

Shaikh, Fouzia Alsabah:
(1) International Conference on Psychology & Psychological Sciences, WASET, Paris, June 28-30, 2010; (2) Department of Health Psychology, Freie University, Berlin, July 1-7, 2010.

Sociological Research Unit

Ramachandran, V.K.:
Hitotsubashi University, Tokyo, Japan, January 15-March 31, 2011.

Swaminathan, Madhura:
(1) Geneva (UN Independent Expert on Human Rights and Extreme Poverty), Switzerland, June 1-2, 2010; (2) Bath, UK, September 12-14, 2010; (3) University of Dhaka, Bangladesh, October 3-5, 2010.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Bangalore

John, Boby:
Hinduja Global Solutions, Manila, Philippines, October 11–15, 2010.

SQC & OR Unit, Kolkata

Anis, M.Z.:
Kuwait University, Kuwait March 8-10, 2011.

Das, Prasun:
Department of Materials Science & Engineering, Iowa State University, Ames, Iowa, USA, May 11-August 7, 2010.

Center for Soft Computing research: A National Facility

Pal S.K.:
(1) University of Salerno, Italy, April 22-May 18, 2010; (2) University of Warsaw, Poland, June 23-30, 2010; (3) China National Convention Center (CNCC), Beijing, China, August 18-20, 2010; (4) Beijing Jiaotong University, Beijing, China October 15, 2010; (5) Chong Qing University of Posts and Telecommunications, Chong Qing, China, October 11-15, 2010; (6) National Cheng Kung University, Tainan, Taiwan, October 30-November 3, 2010; (7) Federal University-ABC, Sao Paulo, Brazil, November 8-14, 2010; (8) University of Sao Paulo, November 8-14, 2010; (9) Hong Kong Baptist University, Department of Computer Science, Hong Kong, February 28-March 9, 2011; (10) Bali Dynasty Resort (International Conference on Data Engineering and Internet Technology - DEIT 2011), Bali, Indonesia, March 14-17, 2011.

Ghosh, A.:
RWTH Aachen University, Germany, August 30-September 30, 2010.

SCIENTIFIC ASSIGNMENTS/ ACADEMIC VISITS IN INDIA

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Bandyopadhyay, Pradipta:
(1) International Congress of Mathematicians Satellite Meeting on “Functional Analysis and Operator Theory”, Indian Statistical Institute, Bangalore, August 08-11, 2010; (2) Gave talk entitled “An Invitation to Ball Remotality in Banach spaces", International Congress of Mathematicians-2010, Hyderabad, August 19-27, 2010.

Barua, R.:
Chaired a session of 11th International Conference on Cryptology in India (INDOCRYPT-2010), Hyderabad, December 12-15, 2010.

Editorial and other Assignments

Basak, Gopal, Krishna:

(1) Invited talk in National Conference on Quantitative Finance at Institute of Mathematics and Applications, Bhubaneswar, February 26-27, 2011; (2) Chaired invited session on Mathematical Finance in the International Congress of Mathematicians-2010, Satellite Conference in Probability and Stochastic Processes, Indian Statistical Institute, Bangalore, August 13-17, 2010.

Behera, Biswaranjan

(1) Attended International Congress of Mathematicians-2010, Hyderabad, August 19-27, 2010; (2) Invited talk “Wavelet packets on local fields”, International Conference on Mathematics, December 31, 2010-January 04, 2011, Allahabad.

Bose, Arup:

Invited speaker, International Congress of Mathematicians Satellite Conference on Probability and Stochastic Processes, Indian Statistical Institute, Bangalore August 13-17, 2010.

Chaudhuri, Probal:

Invited speaker International Congress of Mathematicians-2010, Hyderabad, August 19-27, 2010.

Datta, Mahuya:

(1) Delivered a series of lectures, Annual Foundation School I–Bhaskaracharya Pratisthan, Pune, June 28–July 13, 2010; (2) Attended International Congress of Mathematicians-2010, Hyderabad, August 19-27, 2010; (3) Delivered a series of lectures, School on Analysis, Algebra and Topology–Kerala School of Mathematics, Kozikode, December 13–22, 2010; (4) Delivered talk “From Morse functions to handle-body decompositions”, University of Kalyani, March 04, 2011.

Mrinal K. Das:

Delivered series of talks, "Rings, ideals and modules", International Congress of Mathematicians Satellite Conference, North Eastern Hill University, Shillong, August 30, 2010.

Dutta, Amartya Kumar:

(1) Indian National Science Academy Seminar on History of Science and delivered invited talk "Narayana's treatment of Vargaprakrti", Indian Institute of Technology Madras and University of Madras, October 25-26, 2010; (2) International Conference on Commutative Algebra and Algebraic Geometry and delivered invited talk titled “On A^1-patch by a regular sequence”, Indian Institute of Science, Bangalore, December 06-10, 2010; (3) Delivered the R.C. Gupta Endowment Lecture "Brahmagupta's Contributions to Algebra”, Association of Mathematics Teachers of India, December 28, 2010; (4) Delivered a series of talks on Rings and Ideals to students of mathematics, Sri Aurobindo International Centre of Education, Pondicherry, January 6-15, 2011; (5) Delivered lectures "Mathematics and Astronomy in Ancient India", Ramakrishna Mission Institute of Culture, Kolkata, on February 01, February 15 and March 12, 2011; (6) Delivered talk "Gems from Ancient Indian Mathematics", British Council and Jagadis Bose National Science Talent Search, Kolkata, March 4, 2011.

Maulik, Krishanu:

(1) Delivered talk "Free Subexponentiality", Department of Statistics and Probability, National University of Singapore, June 2010; (2) Attended workshop “Free Probability", Institute of Mathematical Sciences, Chennai July-August, 2010; (3) Attended International Congress of Mathematicians-2010, Hyderabad, August 19-27, 2010.

Poddar, Mainak:

(1) Visited Indian Institute of Science, Bangalore, August, 2010; (2) Attended International Congress of Mathematicians-2010, Hyderabad, August 19-27, 2010.

Sarkar, Rudrapada:
(1) Delivered a series of lectures, Annual Foundation School l–Bhaskaracharya Pratisthan, Pune, June 28–July 13, 2010; (2) Attended International Congress of Mathematicians-2010, Hyderabad, August 19-27, 2010; (3) Delivered lecture, International Congress of Mathematicians Satellite Conference, National Institute of Science Education and Research, Bhubaneswar, August 29–September 02, 2010; (4) Delivered lectures, Tata Institute of Fundamental Research, Mumbai, March 09-12, 2011.

Stat-Math Unit, Delhi

Bandyopadhyay, Antar:
Invited speaker, International Congress of Mathematicians Satellite Meeting on Probability, Indian Statistical Institute, Bangalore, August 13 - 17, 2010.

Bhatia, Rajendra:
(1) Convener, Mathematical Sciences Section Committee, Indian Academy of Sciences, 2010-11; (2) President, Association of Mathematics Teachers of India, 2010-11; (3) Institute Colloquium, Indian Institute Technology, Bombay, September 3, 2010; (4) Visitor's Nominee on Selection Committees of Indian Institute Technology, Bombay, Bhubaneswar, Indore; (5) Invited lecture, Society for Mathematical Sciences, Delhi, February 05, 2011.

Bhatt, Abhay Gopal:
(1) Plenary lecture, 25th Annual Conference of the Ramanujan Mathematical Society, Dr. B.R. Ambedkar National Institute of Technology, Jalandhar, May 3-5, 2010; (2) Member of the Local Organising Committee of International Congress of Mathematicians Satellite Meeting at Indian Statistical Institute, Bangalore, August 13-17, 2010; (3) International Congress of Mathematicians, Hyderabad, August 19-27, 2010.

Dewan, Isha:
(1) Member, Organising Committee, workshop on Reliability and Survival Analysis, Indian Institute of Technology, Mumbai, November 25-27, 2010; (2) Invited talk, National Seminar on Reliability, University of Calcutta, Kolkata, January 28-29, 2011; (3) Invited talk, International Conference, Cochin University of Science and Technology, Kochi, March 25-26, 2011; (5) Ph. D., Supervisor, All Indian Institute for Medical Sciences, New Delhi, August, 2010.

Nandi, Swagata:
(1) Invited lecture "An EM Algorithm for Estimating the Parameters of Bivariate Weibull Distribution under Random Censoring", Conference on Advances in Mathematics and Statistics, Department of Mathematics and Statistics, Indian Institute of Technology, Kanpur, October 29-31, 2010; (2) Participated "Workshop on Reliability Theory & Survival Analysis", Department of Mathematics, Indian Institute of Technology, Bombay, November 25–27, 2010; (3) Invited lecture - Computing Freedom in Education, Research and Technology on the topic "Model fitting with R", National Conventions for Academecis and Research (NCAR-2010), December 16-17, 2010; (4) Invited lecture, National Seminar on Stochastic Modelling and Analysis on "An EM Algorithm for Estimating the Parameters of Bivariate Weibull Distribution under Random Censoring", Department of Statistics, Cochin University of Science and Technology, March 24-25, 2011.

Laishram, Shanta:
(1) Conference on Analytic Questions in Arithmetic, Tata Institute for Fundamental Research, Mumbai, July 23-August 07, 2010; (2) Conference on Analytic and Combinatorial Number Theory, Institute of Mathematical Sciences, Chennai, August 29-September 03, 2010; (3) Invited talk, Scientific Analysis Group, Defence Research & Development Organization, New Delhi, September 06-10, 2010; (4) Workshop "Special Year in Number Theory", Institute of Mathematical Sciences, Chennai, November 30, 2010-January 03, 2011; (5) Invited Talk, B.P.S. Mahila Viswavidyalaya, Khanpur Kalan, Haryana,

Editorial and other Assignments
January 7, 2011; (6) Invited talk, Department of Mathematics, School of Science, Gujarat University, Ahmedabad, February 03-05, 2011; (7) Invited talk, Rajendra Singh Memorial Lecture, Manipur University, Imphal, March 15, 2011;

Roy, Rahul:
(1) Member of the Scientific Committee, International Congress of Mathematicians Satellite Meeting in Probability and Stochastic Processes, Indian Statistical Institute, Bangalore, August 13-17, 2010; (2) Member, Executive Organising Committee, International Congress of Mathematicians, Hyderabad, August 19-27, 2010.

Sarkar, Anish:
Member, Local Organising Committee, International Congress of Mathematicians Satellite Meeting in Probability and Stochastic Processes, Indian Statistical Institute, Bangalore, August 13-17, 2010.

Sarkar, Deepayan:
(1) Conducted workshop “Introduction to Programming in R and Basic Statistical Analysis”, School of Computational and Integrative Sciences, Jawaharlal Nehru University, New Delhi, July 05-09, 2010; (2) Invited lecture “R and its uses in Scientific Analysis”, National Convention for Academics and Research 2010, Hyderabad, December 17, 2010.

Stat-Math Unit, Bangalore

Athreya, Siva:
Gave Lecture Series, Indian Institute of Science Education & Research, Pune, September 27–29, 2010.

Bhat, B.V. Rajarama:
(1) Workshop on “Free Probability”, Institute of Mathematical Sciences, Chennai, July 26–August 6, 2010; (2) Attended International Congress of Mathematicians, University of Hyderabad, August 19–27, 2010; (3) Acted Co-ordinator, Regional Mathematical Olympiad, Karnataka Regional, December 05, 2010; (4) Lecture series, Indian Institute of Science Education & Research, Pune, February 17–18, 2011.

Pati, V.:
Gave series of lectures, Department of Mathematics, Allahabad University, April 01-30, 2010.

Rajeev, B.:
(1) Gave lectures at summer school on “Probability theory and applications”, Kerala School of Mathematics, Kozhikode, May 18–June 6, 2010; (2) Member of the Selection Committee, Department of Statistics, Central University of Rajasthan, October 01–04, 2010.

Raja, C.R.E.:
(1) Attended International Congress of Mathematicians, University of Hyderabad, August 18–28, 2010; (2) Gave invited talk on “Existence of ergodic automorphisms for ergodic actions" at International Congress of Mathematicians-2010, Satellite conference on "Various aspects of dynamical systems", Department of Mathematics, Maharaja Sayajirao University, Vadodara, August 29-September 01, 2010.

Ramasubramanian, S.:
Gave lectures at summer school on “Probability theory and applications”, Kerala School of Mathematics, Kozhikode, Kerala, June 1–7, 2010.

Rao, T.S.S.R.K.:
(1) Attended International Congress of Mathematicians, University of Hyderabad, August 16–26, 2010; (2) Attended 76th Annual Meeting of the Indian Academy of Sciences, National Institute of Oceanography, Goa, November 11–14, 2010; (3) Attended Annual Meeting of the Indian Mathematical Society, NIIT, Surat, December 26–29, 2010; (4) Give a Colloquium talk, Kerala School of Mathematics, March 03 – 06, 2011.

Sastry, N.S.N.:
(1) Gave talks in Advanced Training Schools in Mathematics, Indian Institute of Technology, Mumbai, May 14–28, 2010; (2) Attended International Congress of Mathematicians, University of Hyderabad, August 18–25, 2010; (3) Gave lectures in the Conference on "Groups, actions and computations", Harish-Chandra Research Institute, Allahabad, September 04–11, 2010.

Sreekantan, Ramesh:
Gave talk on "Special values of L-functions", Indian Institute of Science Education & Research, Mohali, September 27-October 07, 2010.

Sury, B.:
(1) Gave lectures "Free groups" in the NBHM school, Indian Institute of Technology, Bombay, May 10-14, 2010; (2) Organize a International Congress of Mathematicians Satellite Conference on "Geometric Group Theory", Goa University, Goa, August 09–13, 2010; (3) Organizing Committee of International Congress of Mathematicians 2010, University of Hyderabad, August 16–27, 2010; (4) Gave lectures on "The ubiquity of the modular group" and on "Chakravala method", Indian Institute of Science Education & Research, Pune, October 17-19, 2010.

Applied Statistics Division

Applied Statistics Unit

SenGupta, A.:
(1) Member, Committee for 67th round of National Sample Survey Organigation, Ministry of Statistics & Programme Implementation, Govt of India, 2010; (2) Member, Committee on Target Rating Point (TRP), Ministry of Broadcasting, Govt of India, 2010–2011; (3) Member, Expert Committee on formation of Department of Statistics in Central University of Bihar, Patna, 2010-2011; (4) External Expert, Interview Committee for Lecturer, Associate Professor and Professor in Dept. of Statistics, University of Bhubaneshwar, 2010; (5) External Expert, Evaluation for Professorship, Department of Mathematics, Indian Institute of Technology, Kharagpur, 2010; (6) Examiner of two Ph.D. theses (both thesis and viva) from Indian Institute of Technology, Kharagpur and Mumbai, 2010; (7) Visiting Professor under UGC scheme, Cochin University of Science and Technology, Cochin, March 2011; (8) Visiting Professor, Shivaji University, Kolhapur, August 2010; (9) Chairman, invited session and invited speaker, International Conference of Forum for Interdisciplinary Mathematics, Patna, December 2010; (10) Chairman, organizer of invited session and invited speaker, 2nd Indian Institute of Management Ahmedabad International Conference on Advanced Data Analysis, Business Analytics and Intelligence, Indian Institute of Management, Ahmedabad, January 2011; (11) Chairman, inaugural lecture and invited speaker, National Seminar on Stochastic Modelling and Analysis, Cochin University of Science and Technology, March 24-25, 2011.

Bayesian Interdisciplinary Research Unit

Pal, A.:
Invited lecture, Workshop on Business Analytics using SAS and SPSS, ICFAI Business School, Kolkata, April 9, 2010.

Editorial and other Assignments

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit

Sur-Kolay, Susmita:
(1) Plenary Lecture, International Conference on Information, Signal and Communication, February 5-6, 2011; (2) Member, Technical Program Committee, 24th International Conference on VLSI Design, January 4-6, 2011.

Das, Nabanita:
(1) Invited attendee, the first Indo-US Workshop on Developing a Research Agenda in Pervasive Communication and Computing Collaboration (PC3), New Delhi, March 9-11, 2011; (2) Session Chair, the 1st International conference on Parallel, Distributed and Grid Computing, Solan, India, October 28–30, 2010; (3) Visited the School of Computer and System Sciences, Jawaharlal Nehru University, New Delhi, October 26, 2010; (4) Chair, WIE (Women in Engineering) Affinity Group of IEEE Calcutta Section, 2010; (5) Program Co-Chair, IEEE INDICON 2010; (6) PC member, Parallel, Distributed and grid Computing-2010, (7) PC member, National Conference on Communication, Institute of Technology Madras, January 29-31, 2010, (7) PC member, National Conference on Emerging Trends and Applications in Computer Science-2010.

Bishnu, Arijit:
Invited lecture, NBHM Workshop on Introduction to Computational Geometry in Research Promotion, Thapar University, Patiala.

Banerjee, Ansuman:
Delivered a tutorial “Principles of Program Slicing - Theory and Applications”, 4th Indian Software Engineering Conference (ISEC-2011), Tiruvananthapuram, February 23-27, 2011.

Bhattacharya, B.B.:
(1) Honorary Research Professor, Bengal Engineering and Science University, Shipur, Howrah, 2010; (2) Invited Lecture, International Symposium on Electronic System Design-2010; (3) PC member, Asian Conference on Computer Vision-2010, International Conference on Pattern Recognition and Machine Intelligence-2011, International Workshop on Combinational Image Analysis-2011; (4) Organizing Co-chair, International Workshop on reliability Aware System Design and Test (RASDAT-2011), Member, Steering Committee, Asian Test Symposium, 2011.

Computer Vision and Pattern Recognition Unit

Chaudhuri, B.B.:
(1) General Chair, 12th International Conference on Frontiers in Handwriting Recognition, Kolkata, November 16-18, 2010; (2) Invited lecture delivered in ICON conference, Kharagpur, December 9-10, 2010.

Palit, S.:
(1) Delivered lectures “Digital Signal Processing”, for B. Tech. students of Radio Physics and Engineering, Information Technology and M. Tech. students of VLSI at the Institute of Radio Physics, Calcutta University, 2010.

Garain, U.:
Delivered lectures, workshop on Intelligent Data Analysis: Theory and Applications, Assam University, Silchar, March 01-05, 2011.

Pal, U.:
(1) Attended 7th Indian Conference on Computer Vision, Graphics and Image Processing, Chennai, India, December 12-15, 2010; (2) Ph. D. Thesis viva, Anna University, December 14, 2010.

Parui, S.K.:
(1) Finance Chair, 12th ICFHR, Kolkata, November 16-18, 2010; (2) Delivered lectures, workshop on Intelligent Data Analysis: Theory and Applications, Assam University, Silchar, March 01-05, 2011.

Bhattacharya, U.:
(1) Organizing Chair, 12th ICFHR, Kolkata, November 16-18, 2010; (2) Delivered lectures, Machine Learning workshop "Intelligent Data Analysis: Theory and Applications", Assam University, Silchar, March 01-05, 2011

Mitra, M.:
Invited lecture, Prof. M.N. Seetaramanath Lecture Series, Andhra University, October 6, 2010.

Documentation, Research and Training Centre

Krishnamurthy, M.:
(1) Conducted Workshop on "KOHA-ILS and DSpace open source software for Digital Repository, Bangalore University, Bangalore, May 7, 2010; (2) Attended Ph.D Registration Committee, Medical Faculty, Rajiv Gandhi University of Health Sciences, Karnataka, Bangalore, May 13, 2010; (3) Invited as resource person, National Workshop on Dspace, RSS audacity and Library blogs to deliver lecture on Dspace, Nmam Institute of Technology, NITTE, June 09-11, 2010; (4) Delivered alk on Institutional Repositories and to install DSpace, Raja Mahendra Pratap Library, Ch. Chran Singh University, Meerut, June 27-30, 2010; (5) Invited as resource person, Training for integrated library management using Koha software, Toyoto Kirloskar Motrs Pvt. Ltd, Sarada Ranganathan Endowment for Library Science, Bangalore, July 19-22, 2010; (6) Invited BLISc degree course paper valuation work, Annamalai University, Annamalainagr, August 25-26, 2010; (7) Invited as resource person, National workshop on "E-resources Consortia and Open Access Initiative in Engineering and Technology", Kalpataru Institute of Technology, Tiptur, January 06-07, 2010; (8) Delivered lecture, "Social Networking: Technologies and its implications to Library and Information Centre", 17th Refresher Course in Library and Information Science, UGC-Academic Staff College, University of Mysore, January 13, 2011; (9) Invited as resource person, Workshop on Digitization, Tumkur University, Tumkur, January 24, 2011.

Devika P. Madalli:
(1) Invited as External Examiner, Ph.D Via-Voce, Vidyasagar University, Medinipur, May 18, 2010; (2) Delivered special lecture on HTML & XML Tutorial, Multilingual Representation in Unicode, PGDLAN-2011, University of Hyderabad, October 08, 2010; (3) Invited as resource person, Workshop on "Digital Libraries and use of e-resource", Ramakrishna Mission Residential College, Kolkata, November 18-19, 2010; (4) Gave special lecture, 17th Refresher Course in Library and Information Science, UGC-Academic Staff College, University of Mysore, January 07, 2011; (4) Attended Ph.D Committee meeting, University of Calcutta, Kolkata, January 25, 2011; (5) Delivered lecture, "Open content management and organization for technical information services", M.S Ramaiah Institute of Technology, Bangalore, February 02, 2011; (6) Discussion, "State of Research and Academic Libraries" Max Muller Bhavan, New Delhi for meeting to held at Hippocampus, Bangalore, February 17, 2011; (7) Gave special talk, "faceted Knowledge organization: from classification to web categorization", International Conference on Digital Libraries and Knowledge Organization (ICDK-2011), Management Development Institute, Gurgaon, February 14, 2011.

Editorial and other Assignments

Prasad A.R.D:

(1) Invited as a Member INLIBNET R & D Panel, INFLIBNET, Ahmedabad, June 7-8, 2010; (2) Participate Brain storming workshop, "Mobilizing invitation for participating in the Information and Knowledge Society: Crossed Perspectives", Indian Institute of Public Administration in association with UNDP-solution Exchange Network and ICSSR, June 21-23, 2010; (3) Participated meeting, Ministry of Culture, Govt. of India. New Delhi, July 08-09, 2010; (4) Attended, Ph.D Viva-Voce Examination at University of Pune, Dept. of Library and Information Science, Pune, July 19-10, 2010; (5) Invited as resource person, Workshop "Creating Digital Libraries using Dspace and Library Automation using KOHA Open source software", Gokhale Institute of Politics and Economics (GIPE), Pune, August 09-13, 2010; (6) Delivered special lecture, "Knowledge Repository from Technological Perspective", National Workshop on "Knowledge Repositories", Dept. of Library and Information Science, Misoram University, Mizoram, November 18-19, 2010; (7) Delivered special lecture, "Liblive CD for Digital Libraries" for the 17th Refresher Course in Library and Information Science organized by UGC-Academic Staff College, University of Mysore, January 07, 2011; (8) Organized, Workshop, on "Developing Digital Libraries using DSpace" and delivered special talk on "Semantic Web Technology: its Applications in LIS", International conference on Digital Libraries and Knowledge Organization (ICDK-2011), Management Development Institute, Gurgaon, February 14-15, 2011.

Raghavan K.S.:

(1) Attended, 48th School Board Meeting of the School of Social Science, Indira Gandhi National Open University (IGNOU), New Delhi, April 15-16, 2010; (2) Invited selection Committee member, appointment of faculty members, Tumkur University, Tumkur, June 06, 2010; (3) Attended, 2nd International Symposium, "Emerging Trends and technologies in Libraries and Inforamtion Services (ETTLIS-2010)", Jaypee University of Information Technology, Solan, June 01-07, 2010; (4) Invited as external member, selection committee meeting for recruitment of Assistant Librarian, Bastar University, Bastar, July 05-06, 2010; (5) Invited as external expert for the selection committee meeting, Dept. of Library and Information Science, Bundelkhand University, Jhansi, September 08-09, 2010; (6) Attended, meeting in connection with Project on "Library Automation and Resource Sharing Network" sanctioned by MHRD, Govt. of India, Bose Institute, Kolkata, February 07-08, 2011; (7) Delivered Special lectures on the Theme on "Libraries in New Information Environment", UGC sponsored Refresher course at Kurukshetra University, Kurukshetra, March 02-03, 2011; (8) Invited as resource person, University Library-Symposium, "ELIS 2011", Anna University, Chennai March 17, 2011.

Ravichandra Rao I.K.:

(1) Invited as Chief Guest and delivered keynote address, National Workshop on Dspace, RSS audacity and Library Blogs, Nmam Institute of Technology, NITTE, June 09, 2010; (2) Attended International conference, "Webometrics, Informatics and Scientometrics," and also delivered lecture on "Multiple Regression Analysis of Informetrics data" in Plenary Session, University of Mysore in association with COLLNET (Germany), October 21, 2010; (3) Invited as resource person and Keynote speaker, "Growth Models related to Informetrics", National Workshop, "Scientometrics", Karnataka University, Dharwad, October 25, 2010; (4) Attended, Departmental Promotion Committee Meeting, ISRO, Bangalore, November 02, 2010; (5) Delivered special lecture, "Scientoemtric Indicators to measure scientific productivity with special emphasis on 'impact factor' and h-index", CFTRI, Mysore, November 19, 2010; (6) Inaugurated and delivered keynote address, Library Automation Package and its integration with Digital Tool, NCSI, Indian Institute of Science, Bangalore, November 29, 2010; (7) Delivered special lecture, 17th Refresher Course in Library and Information Science, UGC Academic Staff College, Dept. of Library and Information Science, University of Mysore, January 10, 2011; (8) Attended the Advisory Committee Meeting of UGC/SAP, Dept. of Library and Information Science of the Karnataka University Dharwad, January 11-13, 2011.

Electronics and Communication Sciences Unit

Mukherjee, Dipti Prasad:
(1) Invited lecture, AICTE SDP, Kalyani Government Engineering College, Kalyani, June 14, 2010; (2) Invited lecture, Symposium on Computer Education: Needs and Expectations, BIT Mesra, November 12, 2010; (3) Invited lecture, National Student Convention, CSI 2010, Mumbai, November 25; 2010; (4) Keynote lecture, International Conference, Signal and Image Processing, Chennai, December 15, 2010.

Chanda, B.:
(1) Invited lecture, 'Refresher Course' on "Image Processing and Pattern Recognition', Heritage Institute of Technology, Kolkata, January 24--25, 2011; (2) Invited lecture, Workshop on 'Advances in Signal and Image Processing', Jawaharlal Nehru Technological University, Kakinada, February 25--26, 2011; (3) Session Chair, ICVGIP'10, IITM, Chennai, December 12--16, 2010; (4) Session Chair, EAIT'10, CSI, Kolkata, February 19--20, 2011.

Pal, N.R.:
(1) Addressed Keynote speech, International Conference on IT and Business Intelligence (ITBI10), Nagpur, November 12-14, 2010; (2) Invited lecture, Workshop on 'Advances in Signal and Image Processing', Jawaharlal Nehru Technological University, Kakinada, February 25--26,2011.

Bagchi, Aditya:
(1) Invited lecture, "Tools and Techniques of Data Collection and Analysis : A data mining experience", Seminar series on Research Methodology, Bengal Engineering & Science University, December 15, 2010; (2) Invited lecture, "Data modeling for social network applications", Symposium on Computer Education: Needs and Expectations, Birla Institute of Technology, Mesra, Ranchi, November 19, 2010; (3) Invited lecture, "Data modeling and security issues of social network", Tutorial lecture in 2nd International Conference on Emerging Applications of Information Technology (EAIT 2011), Kolkata, February 18, 2010; (4) Invited lecture, Symposium on Computer Education: Needs and Expectations, Birla Institute of Technology, Mesra, Ranchi, November 2010; (5) Delivered series of lectures, connection with research methodology, Mody Institute of Technology & Science, Jaipur, Rajasthan, March, 2011.

Pal, Srimanta:
Visited for technical discussion, National Physical Laboratory, Delhi, February 28-March 5, 2011.

De, Arun K.:
Visited for technical discussion, National Physical Laboratory, Delhi, February 28-March 5, 2011.

Deb N.C.:
(1) Invited lecture, National Conference on “Instrumentation & Control NATCONIC-2011”, Department of Applied Electronics & Instrumentation Engineering, Heritage Institute of Technology, January 06-07, 2011; (2) Invited as Visiting Scientist, for scientific discussion on investigation of aerosol on Indo Gangetic plane with the scientific group engaged in research in this field, National Physical Laboratory, New Delhi, February 28–March 4, 2011.

Machine Intelligence Unit

Bandypadhyay, S.:
(1) Invited lectures, JIS College, Kalyani, August 05-06, 2010; (2) Invited talk, BIT Deoghar, September 03-04, 2010; (3) Invited talk, NIT Durgapur, November 08-12, 2010; (4) Invited talk, Jawaharlal Nehru University, New Delhi, December 13-14, 2010; (5) Invited talk, Jadavpur University, Kolkata, December 19, 2010; (6) Invited talk, Humboldt Kolleg, Bangalore, February 04, 2011; (7) Invited lecture, IICB, Kolkata, February 06-09, 2011.

Editorial and other Assignments
Biswas, S.:
Visited, Institute of Mathematical Sciences, Chennai, February 21-25, 2011.

Ghosh, A.:
(1) PhD thesis evaluation, Utkal University, October 30-31, 2010; (2) Invited talk, G.R. Govindorajulu School of Applied Computer Technology, PSGR Krishnammal College for Women, Coimbatore, December 10-12, 2010; (3) Invited talk, Workshop on Soft Computing and Applications (WSCA-11), S'O'A university, Bhubaneswar, January 12-15, 2011; (4) Invited talk, PSNA college of Engineering, Madurai, March 30, 2011.

Kundu M.K.:
(1) External expert member, Doctoral Committee of Faculty of Engineering, Department of Computer Science, Bengal Engineering and Science University, Sibpur, July 23, 2010; (2) External examiner, Ph.D degree thesis and Viva examination, Computer Science & Engineering department, IIT Madras, May 31, 2010; (3) Member of the Technical Program Committee, 7th Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP-10), IIT Madras, Chennai, December 12-15, 2010; (4) Member of the Technical Program Committee, 2nd International Conference on Emerging Applications and Information Technology (EAIT-2011), Kolkata, India, February 18-20, 2011; (5) Member of the Academic Council, Indian School of Mines University, Dhanbad September 12, 2010; (6) Member Ph.D committee, Department Radio Physics and Electronics, Calcutta University, Kolkata January 14, February 17 and March 29, 2011; (7) Member of the selection committee, Summer fellowship program, Indian Academy of Sciences(IAS), Indiana National Science Academy(INSA) and National Academy of Sciences, India(NASI), January 12-13, 2011.

Mitra, S.:
(1) Invited lecture, IEEE Students' Technology Symposium, IIT Kharagpur, April 03, 2010; (2) Invited lecture, International Conf. on Systems in Medicine and Biology, IIT Kharagpur, December 16, 2010; (3) Invited lecture, Winter School on Soft Computing, Tezpur University, December 23, 2010; (4) Invited lecture, National Conference on Trends in Machine Intelligence, Tezpur University, March 25, 2011; (5) Invited lecture, IIT Guwahati, March 28, 2011.

Murthy, C.A.:
(1) Invited lecture, Ramrao Adik Institute of Technology (RAIT), Mumbai, August 19, 2010; (2) Ph.D Viva evaluation, Tezpur University, August 27, 2010; (3) Invited talk, International Conference and exhibition on Biometric Technology, PSG College of Technology, Coimbatore, September 03-05, 2010; (4) Delivered talk, National Bureau of Animal Genetic Resources, Karnal, Haryana, November 12, 2010; (5) Video recording of lectures on pattern recognition, IIT Madras, January 02-06, 2011.

Systems Science and Informatics Unit

Majumdar, K.K.:
(1) Invited lecture, 4th National Conference of the Indian Society of Sleep Research, Thiruvananthapuram, Kerala, December 13, 2010; (2) Invited lecture, "Cortical Source Localization of Human Scalp EEG", National Conference on Communications-2011, January 28, 2011.

Saroj K. Meher:
Delivered key note speech, International Conference on Communication, Computing & Security (ICCCS2011), February 12-14, 2011.

Sagar B.S.D.:
(1) Invited lecture, Indian Statistical Institute-Karnataka Chapter, February 25, 2011; (2) Invited lecture, Bangalore University, September 18, 2010; (3) Member Board of Studies, Computer Science Department, RV College of Engineering; (4) Member Technical Program Committee (TPC), IEEE

International Geoscience & Remote Sensing Symposium, Vancouver, Canada, July 2011; (5) Member of Doctoral Committee, Indian Institute of Space Science Technology (IIST), Trivandrum, 2011.

Physics and Earth Sciences Division

Geological Studies Unit

Bhattacharya, S.:
Participated AOGS, Hyderabad, July 05-09, 2010.

Das, S.S.:
Visited and inspect type gastropod material from Kutch, Western India, Banaras Hindu University, February 26-28, 2011.

Saha, Dilip:
(1) Participated, 7th Asia-Oceania Geosciences Society Annual Meeting, Hyderabad, July 04-09, 2010; (2) Participated, 1st SGTSGI National Conference on Rock Deformation and Structures (RDS–I), October 29-31, 2010; (3) Delivered, 34th Professor S. Ray Memorial Lecture, Presidency University, Kolkata, September 08, 2010; (4) Delivered Lecture, Colloquium on Problems in Indian Geology: Retrospect and Prospects, Benaras Hindu University, October 07, 2010; (5) Delivered Inaugural Lecture, Geological Survey of India Geologist Trainees, Kolkata, November 20, 2010.

Physics and Applied Mathematics Unit

Ghosh, S.:
Academic Collaboration, Department of Physics, Institute of Mathematical Sciences, Chennai, April 30-May 16, 2010.

Kar, Guruprasad:
Academic Collaboration, Institute of Mathematical Sciences, Chennai, November 22-December 02, 2010.

Pal, Supratik:
(1) Invited talk, Indian Institute of Technology, Kharagpur, July 20–22, 2010; (2) Harish-Chandra Research Institute, Allahabad, December 14–18, 2010.

Roy, Sisir:
(1) Invited talk, National Workshop on Modeling Biological Systems, NEHU, Shillong October 25-29, 2010; (2) Invited, Government of Sikkim regarding Education Policy, Gangtok, December 19-24, 2010.

Roy, Kr. Ashim:
Academic collaboration, IUCAA, Pune, February 14–26, 2011.

Biological Sciences Division

Biological Anthropology Unit

Mukhopadhyay, B.:
Visited, Pondicherry University, September 08, 2010.

Mukhopadhyay, S.:
Pondicherry University, September 08, 2010.

Editorial and other Assignments

Human Genetics Unit

Ghosh, S.:
(1) Delivered lecture, Workshop on Microarrays, Manipal University, New Delhi, August 04-06, 2011; (2) Attended, Annual Meeting of Indian Society of Medical Statistics Meeting, National Institute of Health and Family Welfare, New Delhi, November 10-11, 2010.

Social Sciences Division

Economic Research Unit

Kabiraj, Tarun:
(1) Invited lecture, Refresher Course, Department of Business Management, Calcutta University, August 19, 2010; (2) Invited Lecture, Economic Summit Confluence 2010, St. Xavier's College, Kolkata, September 28, 2010; (3) Acted, Jury for the event of "paper presentation" at the Young Economist Students' Meet 2010, Jadavpur University, 2010.

Sarkar, Nityananda:
(1) Invited lectures, Time Series and Regression Analysis, Department of Statistics, Gauhati University, Gauhati, December 22-23, 2010.

Linguistic Research Unit

Dasgupta, Probal:
(1) Attended, 4th Indo-US Roundtable, Office of Naval Research with National Institute of Advanced Studies, Bangalore, September 20-22, 2010; (2) Attended, National Seminar on Translating Knowledge Texts, National Translation Mission, Central Institute of Indian Languages, Mysore (with University of Kolkata), Dept of Linguistics, September 25, 2010; (3) Attended, International Workshop on Cognitive Science, Dept. of Science and Technology with University of Trento, Italy, University of Hyderabad, October 26-28, 2010; (4) Attended, Centre for Neural and Cognitive Sciences, University of Hyderabad, December 13, 2010; (5) Presented paper, 32nd All-India Congress of Linguists, Linguistic Society of India with Lucknow University, Lucknow, December 20-23, 2010; (6) Attended, National Seminar on Language and Culture in the Making of a Nation: Linguistic Perspectives, University of Mumbai, January 26-27, 2011; (7) Presented keynote address, International Seminar on Tagore at Home and in the World, Department of English, Calcutta University, February 12-13, 2011; (8) Attended, International Conference on Character of Mind, Indian Institute of Advanced Study, Shimla, with Delhi University Dept. of Philosophy, March 18-19, 2011.

Dash, Niladri Sekhar:
(1) Invited Lecture, National Seminar-cum-Workshop on Recent Trends in Language teaching, institute of Advanced Studies in Education, David Hare College, Kolkata, June 04, 2010; (2) Visited Ramakrishna Mission Vivekananda University, Belur Math, Howrah, July 2010-January 2011; (3) Invited Lecture, National Workshop on Corpus Normalization organized by the Linguistic Data Consortium for the Indian Languages (LDCIL), CIIL, Mysore, August 25, 2010; (4) Invited Lecture, Refresher Course in Linguistics and English Language Teaching, UGC Academic Staff College, Ranchi University, Jharkhand, November 29, 2010; (5) Invited Lecture, Orientation Programme on Methodology of Teaching English for the in-service teachers of Secondary & Higher Secondary schools of West Bengal, in CTE Orientation Programme (4th Phase), Ramakrishna Mission Sikshanmandira, Belur Math, Howrah, MHRD, Govt. of India, January 12, 2011; (6) Consulted, Language Processing in Bilingual Users of South Asian Languages, Department of Psychology,

Faculty of Arts & Social Sciences, University of Windsor, Ontario, Canada, 2010; (7) Coordinator, Development of Electronic Databases of Word-formation Parameters for 200 Languages across the World, Dept. of British and American Studies, Faculty of Arts, P.J. Šafárik University in Košice, Moyzesova 50, Slovakia, 2010; (8) Evaluating Committee Member, Bangla Tree-Bank, Indian Institute of Technology, Kharagpur, 2010; (9) Principal Investigator, Language Attitude Survey in three villages in Giridih, Jharkhand among school teachers about their attitudes towards their mother tongues and languages they use, March 21–24, 2011.

Planning Unit

Das, Satya P.:
Visited, Department of Analytical & Applied Economics, Utkal University Bhubaneswar, January 19–March 31, 2011.

Ghate, Chetan:
Visited, Indian Institute of Advanced Study, Shimla, April 01–July 01, 2010.

Mukhopadhyay, Abhiroop:
Visited, Institute of Economic Growth, Delhi, July 15, 2010–March 31, 2011.

Psychology Research Unit

Bhattacharya, H.:
Attended, International Conference on Recent Advances in Cognitive Science, Department of Psychology, Banaras Hindu University, December 18-20, 2010.

Dutta Roy,D.:
(1) Delivered lecture, “Music therapy in Geriatric disorders" by the Calcutta Metropolitan Institute of Gerontology, June 12, 2010; (2) Delivered lecture, “Measurement Scales and Principles of Questionnaire development”, UGC Academic staff college, University of Calcutta, December 03, 2010; (3) Attended and delivered lecture, “Self-Efficacy Life Skills of Chemical and Organic Substance using Agricultural Farmers in West Bengal”, 46th National and 15th International Conference of the Indian Academy of Applied Psychology, Department of Studies in Psychology, University of Mysore, February 04-06, 2011. (4) Delivered lecture, “Exploring work values in Rabindra Sangeet”, Jyotirmoy School of Business, Kolkata, February 26, 2011; (5) Conducted, “2 days Workshop on SPSS Syntax”, Indian Institute of Psychometry, Kolkata, October 28, 2010; (6) Attended, Workshop on “Questionnaire development”, Prasad Psycho Corporation, Mysore, February 02, 2011; (7) Attended, Workshop on “Questionnaire development and Introduction to Psychoinformatics”, Amrita School of Business, Amrita Vishwa Vidyapeetham, Ettimadai, Coimbatore, January 03, 2011; (8) Chaired technical session, “1st International Conferences on People Management in Organizations: Issues & Challenges”, JSB, Kolkata, February 27, 2011; (9) Provided research consultancy, Defence Institute of Psychological Research, Defence R&D Organization, Ministry of Defence, February, 2011.

Ghosh, A.:
(1) Chaired technical session, International Conference on Management and Social Welfare Issues: Perspectives, IISWBM, Kolkata, January 03, 2010; (2) Participated, Workshop on PREP and COGENT, Hyderabad, February 04-06, 2011; (3) Delivered lecture, “Domestic Violence”, Bhairab Ganguly College, Kolkata, March 28, 2011; (4) Ethics Committee Member, AMRI Hospitals, Kolkata, 2010.

Gupta, R.:
Attended, National Conference on Psychological Measurement: Strategies for the New Millennium, Discipline of Psychology, School of Social Sciences, IGNOU, New Delhi, March 04-05, 2011.

Editorial and other Assignments

Sociological Research Unit

Chattopadhyay, Molly:
Attended, Annual Survey of Industries: Scope, Coverage and Quality, Central Statistical Office, Kolkata, October 07, 2010.

Ghosh, Bholanath:
(1) Academic Counselor, Indira Gandhi National Open University, Bhairav Ganguly College Centre, 2010; (2) Delivered lecture, National Seminar on Management of Natural Resources and Environment in India, Guru Nanak University, Amritsar, October 23-24, 2010; (3) Delivered lecture, XXXVI All India Sociological Conference, Ravenshaw University, Cuttack, Orissa, December 27-29, 2010; (4) Delivered lecture, 8th Conference of Indian Association for Social Sciences and Health, "Health, Environment and Sustainable Development", Department of Population Studies and Social Work, Sri Venkateswara University, Tirupati, February 11-13, 2011; (5) Delivered lecture, National seminar on "Gender Budgeting, Steps towards Justice", Ghatal Rabindra Satabarsiki Mahavidyalaya, Ghatal, Paschim Medinipur, March 17-18, 2011.

Jana, R.:
Attended, "Importance of weighted social networks in diffusion of agricultural innovations: An empirical study", 4th Annual Conference of the Sociological Association of West Bengal, December 6, 2010.

Ramachandran, V.K.:
(1) Appointed Editor-in-Chief of the Review of Agrarian Studies, 2010; (2) Delivered the Radhakamal Mukherjee lecture, Annual Conference of the Indian Society of Labour Economics, Karnatak University, Dharwad, December 17-19, 2010.

Swaminathan, Madhura:
(1) Attended, International Conference on Eliminating Hunger and Poverty, M.S. Swaminathan Research Foundation, Chennai, August 07-09, 2010; (2) Delivered lecture, "Rural Income and Income Inequality", International Conference on Public Policy and Management, IIM Bangalore, August 10-11, 2010; (3) Delivered Vinod Choudhury Memorial lecture, "Can the Right to Food be Targeted", St. Stephen's College, Delhi, October 23, 2010; (4) Delivered lecture, National Workshop on Economic Planning, Development and the West Bengal Economy, Jadavpur University, January 10, 2011; (5) Member, Seminar and Travel Grant Committee of the Indian Council of Social Science Research, New Delhi, 2010; (6) Member, First Executive Council of Sikkim University, Gangtok, 2010.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Bangalore

Gijo, E.V.:
(1) Delivered Lecture, Workshop on "Applied Statistical Methods in Quality Control", Nirmala College, Muvattupuzha, Kerala, March 03, 2011; (2) Delivered Lecture, Workshop on Statistical Applications in Industry, Business, Agriculture and Ecology, St. Thomas College, Pala, Kerala, March 26–28, 2011.

Ray, Somnath:
Delivered Lecture, Workshop on "Applied Statistical Methods in Quality Control", Nirmala College, Muvattupuzha, Kerala, March 03, 2011.

Boby, John:
(1) Delivered Lecture, Staff Development Program on Design of Experiments and Taguchi Methods, Siddaganga Institute of Technology, Tumkur, June 30, 2010; (2) Delivered Lecture, Workshop on Data

Mining using Rapid Miner, Dr. N.G.P. Institute of Technology, Coimbatore, October 08, 2010; (3) Delivered Lecture, Staff Development Program on Industrial Statistics using Minitab, Siddaganga Institute of Technology, Tumkur, January 24-25, 2011.

SQC & OR Unit, Coimbatore

Rajagopal, A.:
(1) Delivered Lecture, ICT in Productivity Improvement, NIFT TEA, Tirupur, July 04, 2010; (2) Delivered Lecture, Lean six sigma Implementation to SMEs organized by Ministry of Small Medium Industries ACCESSIO Expo., Chennai Trade Centre, September 12, 2010; (3) Delivered Lecture, FMEA, Coimbatore Productivity Council, September 12, 2010; (4) Delivered Lecture, Lean Six Sigma organized by Textile Committee, PSG College of Technology, September 16, 2010; (5) Delivered Lecture, Lean Manufacturing Practices to SME's, Madurai District Tiny and small Scale Industries Association, December 10, 2010; (6) Delivered Lecture, "Statistical Techniques in Process Improvements" Cotton Blossom Garment Group, January 09, 2011; (7) Delivered Lecture, "Control Charts", Fluid Control Research Institute, Palakkad, Kerala, February 08, 2011.

SQC & OR Unit, Delhi

Neogy, S.K.:
(1) Delivered Lecture, "Optimization Models for a class of structured Stochastic games", Satellite Conference of International Congress of Mathematician (ICM-2010), Mathematics in Science and Technology, New Delhi, August 14-17, 2010; (2) Delivered Lecture, "Statistics as a Key Technology in Real Life Applications" on World Statistics Day at Ramjas College, University of Delhi during October 20, 2010; (3) Delivered Lecture, "Game theory, Applied Statistics", Refresher Course for three weeks on Mathematics and Operational Research, Centre for Professional Development in Higher Education (UGC Academic Staff College) of University of Delhi, December 13, 2010-January 4, 2011; (4) Delivered Lecture, "Karmarkar's Algorithm and Its Various Extensions Revisited", International Conference on Frontiers in Applied Mathematics and its Computational Aspects, Department of Applied Mathematics, Calcutta University, March 15-17, 2011.

SQC & OR Unit, Hyderabad

Murthy, G.S.R.:
Viva examiner, Evaluating the Ph.D. thesis, Indian Institute of Technology, Madras, Chennai, 2010.

SQC & OR Unit, Kolkata

Das, Prasun:
Delivered Lecture, Fundamentals of Artificial Neural Network, BITS, Deoghar, September 03-04, 2010.

Pradhan, B.:
Delivered Lecture, Mathematics & Statistics Department, Indian Institute of Technology, Kanpur, August 26-28, 2010.

Das, A.K.:
(1) Delivered Lecture, Mixture design, ,Department of Statistics, University of Calcutta, April 17, 2010; (2) Delivered Lecture, Algorithm and its Computational Complexity, International Conference on Frontiers in Applied Mathematics and its Computational Aspects (ICFAM-CA 2011), Department of Applied Mathematics, University of Calcutta, March 15-17, 2011.

Editorial and other Assignments
Chakraborty, A.K.:
(1) Delivered Lecture, "Software Reliability Modeling with Interval Debugging Schedule", International Conference on Frontiers in Applied Mathematics and its Computational Aspects (ICFAM-CA 2011), Department of Applied Mathematics, University of Calcutta, March 15-17, 2011; (2) Delivered Lecture, "Quality Improvement in Distance Education with emphasis on the role of Infrastructure, Planning and Management", Identifying Quality Parameters in Distance Education, Netaji Subhas Open University, Kolkata, March 24, 2011.

Majumdar, S.K.:
Attended Training Programme, Breakthrough in Research (for the Scientists of CSIR laboratories), HRDC, CSIR, Gaziabad, Delhi, February 21-25, 2011.

Library, Documentation and Information Science Division

Library, Kolkata

Raychaudhury, Arup:
(1) Invited lectures, UGC sponsored Refresher Course on Management of Libraries and Information Centers in Digital Era, Mizoram University, March 09-10, 2011; (2) Invited lecture, Change Management in Libraries, Sarada Ranganathan Endowment for Library Science, Bangalore, September 27, 2011.

Ganguly, Nibedita:
Attended, 24th Indian Association of Special Libaries and Information Seminar, Deen Dayal Upadhay Gorakhpur University, Uttar Pradesh, December 18-21, 2010.

Mandal, Tapan Kumar:
Attended, International Conference on digital Library Management (ICDLM), Organized The Energy and Resources Institute (TERI) jointly with Raja Rammohan Roy Library Foundation, Science City, Kolkata, January 11-13, 2011.

Basak, Nanda Dulal:
Attended, International Conference on digital Library Management (ICDLM), Organized The Energy and Resources Institute (TERI) jointly with Raja Rammohan Roy Library Foundation, Science City, Kolkata, January 11-13, 2011.

Sarkar, Aloka:
Attended, 24th Indian Association of Special Libaries and Information Seminar, Deen Dayal Upadhay Gorakhpur University, Uttar Pradesh, December 18-21, 2010.

Pal, Ashis Kumar
Attended Workshop, Library Automation using KOHA: Open Source Software and Dspace-Digital Library Software, Bose Institute, Kolkata, September 29-October 01, 2010.

Das, Subrata:
Attended Workshop, Library Automation using KOHA: Open Source Software and Dspace-Digital Library Software, Bose Institute, Kolkata, September 29-October 01, 2010.

Das, Prabir Kumar:
Attended, Society for Information Science Conference, "Open Access Gateway to Open Innovations", Organized Society for Information Science in collaboration with Bose Institute & Indian Institute of Chemical Biology, Bose Institute Auditorium, Kolkata, November 24-26, 2010.

Ghosh, Biswajit:
Attended Workshop, Library Automation using KOHA: Open Source Software and Dspace-Digital Library Software, Bose Institute, Kolkata, September 29-October 01, 2010.

Center for Soft Computing Research: A National Facility

Ghosh, A.:
Coordinated Workshop & Delivered a lecture, Soft Computing and Applications (WSCA'11), organized CSCR, ISI and Siksha 'O' Anusandhan (SOA) University, Bhubaneswar, January 12-15, 2011.

Ghosh, K.:
(1) Delivered Invited lecture, National Workshop on Modelling Biological Systems, North Eastern Hill University, Shillong, October 25-29, 2010; (2) Delivered Invited lecture, ISI-Tezpur University Winter School on Soft Computing, Tezpur, Assam, December 20-23, 2010; (3) Delivered Invited lectures, DST Program INSPIRE, Mizoram University, Aizawl, March 01-03, 2011.

Pal, S.K.:
(1) Delivered Inaugural talk & Keynote talk, International Conference on Systems in Medicine & Biology, Indian Institute of Technology, Kharagpur, December 16-18, 2010; (2) Delivered Keynote talk, Workshop on Soft Computing and Applications (WSCA'11), Institute of Technical Education and Research (ITER), Siksha 'O' Anusandhan (SOA) University, Bhubaneswar, Orissa, January 13-15, 2011; (3) Delivered Keynote talk, National Conference on Emerging Trends in Soft Computing, Nowrosjee Wadia College, Pune University, February 02-03, 2011; (4) Delivered Keynote talk, Analysis of Nonlinear System, Viswa Bharati, Santiniketan, March 12-13, 2011.

PART III. ADMINISTRATION AND OFFICE BEARERS

10. GENERAL ADMINISTRATION

Administrative Services Division

The Administrative Services Division at the headquarters caters to the various needs of the scientific workers in all the scientific units of the Institute engaged in various scientific, research and academic activities and provides them with necessary infrastructural facilities in their pursuit of excellence. The centres at Delhi, Bangalore and Chennai, each having a number of science units are, by and large, getting administrative support from the administrative units/sections there. The Administrative Division has the following units at the Headquarters in Kolkata:

Sl. No.	Name of the Unit	Sl. No.	Name of the Unit
1.	Accounts Section	17.	Import & Travel Cell
2.	Audio-Visual Unit	18.	Internal Audit Cell
3.	Binding Unit	19.	Legal Cell
4.	Canteen	20.	Medical Expenses Reimbursement Unit
5.	Cash	21.	Medical Welfare Unit
6.	C E (A & F)'s Office	22.	Personnel Unit
7.	Central Office & Despatch Unit	23.	Provident Fund Unit
8.	Central Stores & Tailoring Unit	24.	Public Relations Unit
9.	Council Section	25.	Publication and Printing Unit
10.	Director's Office	26.	Rajbhasha / Hindi Cell
11.	Electrical Maintenance Unit	27.	Retirement Benefit Cell
12.	Engineering Unit	28.	Sankhya Office
13.	Estate Office	29.	Security Unit
14.	Guest House	30.	Telephone Unit
15.	Hostels	31.	Transport Unit
16.	House Building Cell		

Apart from the Units mentioned above, there are some small cells dealing with Budget, SC / ST issues etc. to take care of the specific needs of the Institute. The Administrative Services Division also looks after the running of hostels for students, research scholars and International Statistical Education Centre (ISEC) trainees and also the running of Canteen for the workers and students of the Institute. The other outlying Units are controlled directly by the headquarters at Kolkata. The Administrative Services Division takes the responsibility for all new construction activities of the Institute at its headquarters and also at outlying centres/branches. A brief report on the construction activity in the current year is narrated in the subsequent paragraphs.

The activities of the Administrative Services in the three Centres, namely Delhi, Bangalore and Chennai and in other outlying branches of the Institute and Giridih Office, are more or less similar but on a much smaller scale.

Officers of the Institute administration during the year:

Director	:	Bimal K. Roy
Professors-in-Charge of Scientific Divisions	:	Goutam Mukherjee (Theoretical Statistics & Mathematics)
		Subhamoy Maitra (Applied Statistics)

Madhura Swaminathan (Social Sciences)

Sisir Roy (Physics & Earth Sciences)

Anjana Dewanji (Biological Sciences)

Subhas Chandra Nandy (Computer & Communication Sciences)

Head, SQC & OR	:	Amitava Bandyopadhyay
Head, Delhi Centre	:	R.B. Bapat
Head, Bangalore Centre	:	T.S.S.R.K. Rao
Head, Chennai Centre	:	D. Sampangi Raman (Officiating)
Dean of Studies	:	B.P. Sinha
Chief Executive (A & F)	:	S.K. Iyer

List of workers who joined/retired/voluntarily retired/resigned/terminated/died during the year

Appointments

Scientific/Technical Workers

Sl. No.	Name		Sl. No.	Name
1.	R. Venkatesh Babu		6.	Saroj Kumar Meher
2.	Anita Naolekar		7.	Kishan Chand Gupta
3.	Shanta Laishram		8.	Arnab Chakraborty
4.	Arindam Chatterjee		9.	Abhishek Bhattacharya
5.	Ansuman Banerjee			

Non-Scientific Workers

Sl. No.	Name		Sl. No.	Name
1.	Gopal Mandol		4.	Arpita Konar (Basak)
2.	Om Prakash		5.	Sujan Dutta
3.	Satyajit Dasgupta		6.	Palash Chandra Karan

Retirement/Voluntary Retirement

Scientific/Technical Workers

Sl. No.	Name		Sl. No.	Name
1.	Ratna Saha		6.	Tapan Kr. Paul
2.	Tapas Kr. Sengupta		7.	Tapan Kr. Guha
3.	Sital Chatterjee		8.	Lal Babu Ray
4.	Bablu Chatterjee		9.	Dilip Kr. Ghosh
5.	Ashok Chakraborty		10.	Debashis Bhattacharya

Administration

Non-Scientific Workers

Sl. No.	Name		Sl. No.	Name
1.	Benoy Krishna Banik		13.	Amalendu Biswas
2.	Shankari Lal		14.	Net Lal Routh
3.	Sambbu Nath Dey		15.	Kalipada Bera
4.	S.C. Sharma		16.	Motilal Das
5.	D. Siddappa		17.	Basant
6.	Ivi Dutta		18.	Babaji Biswal
7.	Shanti Malakar		19.	Subodh Acharya
8.	Gobinda Ch. Das		20.	Bhagai Devi
9.	Swapan Kr. Seal		21.	Paritosh Adhikary
10.	Tribeni Oraon		22.	Mahagilal Balmiki
11.	P.K. Unnikrishnan		23.	Biman Ch. Basu
12.	Naro Oraon		24.	Biren Behara

Resignation/Termination

Scientific/Technical Workers

Sl. No.	Name		Sl. No.	Name
1.	Upendra Kulkarni		3.	R. Venkatesh Babu
2.	Bikram Roy			

Non-Scientific Worker

Sl. No.	Name
1.	Prabodh Panchadhyayee

Death

Scientific/Technical Worker

Sl. No.	Name
1.	Shibnarayan Mirdha

Non-Scientific Workers

Sl. No.	Name		Sl. No.	Name
1.	Parameswar Mahato		3.	Samir Chakraborty
2.	J. Sattaiah		4.	Belmati Roy

Number of workers in the Institute as on 31 March 2011:

(i)	Scientific and Technical Workers	-	700
(ii)	Non-Scientific Workers	-	404
	Total	:	1104

Breakup of manpower by Gender, Social category and Disability group as on 31 March 2011

Total Strength		Physically Handicapped (PH)	Scheduled Caste (SC)	Scheduled Tribe (ST)
Male	945	06	112	31
Female	159	NIL	15	01
Total	1104	06	127	32

Applications received and action taken by the Institute under RTI Act, 2005

Name of the Appellate Authority: Professor Bimal K. Roy, Director of the Institute.

Name of Central Public Information Officer: Shri S.K. Iyer, Chief Executive (Admn. & Finance) of the Institute.

A total number of 27(twenty seven) applications were received by the Central Public Information Officer of the Institute during 2010-11, out of which 3(three) applications were rejected due to non-receipt of application fees. Central Public Information Officer provided information against remaining 24(twenty four) applications within the stipulated date. 4(four) applications were received by the Appellate Authority and all the 4 cases were heard and disposed of by the Appellate Authority. The summary statement in this regard for the year 2010-11 is appended below:-

No. of Applications received	No. of cases accepted	Decisions where requests were fully or partially rejected		No. of decisions from Appellate Authority	C I C decision			Amount collected (Rs.)		
		Fully rejected	Partially rejected		No. of decisions received	Penalty imposed	Disciplinary action, if any	Fee	Other Charges	Penalty amount
27	24	3	-	4	4	NIL	NIL	245	167	NIL

Budget and Finance

For the year 2010-2011, Section 8(1) Committee recommended Rs.10145.80 lakhs (Government Grant Rs.9920.00 lakhs and ISI internal receipt Rs.225.80 lakhs under Non-Plan (BE) and Rs.3393.84 lakhs under Plan (BE). The Government approved a sum of Rs.9101.12 lakhs and of Rs.2800 lakhs for Non-Plan and Plan expenditure respectively. At the revised estimate stage, the Institute sought for a grant of Rs.10682.50 lakhs and Rs.3724.79 lakhs under Non-Plan and Plan respectively which also recommended by the Section 8(1) Committee. The Government sanctioned a grant of Rs.10420.16 lakhs (including the unutilized amount of Rs.484.15 lakhs during the financial year 2009-2010) under

Administration

Non-Plan and the Plan RE allocation was fixed at Rs.4382.13 lakhs (including the unutilized amount of Rs.782.13 lakhs during the financial year 2009-2010). The expenditure during report was well within the budget allocation sanctioned by the Government. The Audited Annual Accounts of the Institute for the year 2010-2011 have been furnished in Part IV of this report.

Major Construction / renovation works taken up by the Institute during 2010 - 2011

Kolkata

Construction of Platinum Jubilee Academic Building at ISI.

The Institute started the work of construction of the Platinum Jubilee Academic Building during the year 2006-2007. The building has been completed and already occupied by the user units. The work of the Auditorium has been completed during this financial year.

An amount of Rs.52.14 lakhs has been paid to the agencies and the consultant regarding the subject work.

Construction of ISEC Building at 202 Campus.

The Institute took up the construction of the ISEC Building at 202 Campus with an intention of providing all the facilities under one roof for the ISEC students. The building will have facilities like Class Rooms, Seminar Hall, Library, Accommodation for Students and Visiting Faculties, Dining Hall, Recreation Facilities, etc. The structural work has been completed and the finishing works like air-conditioning, installation of lifts are under progress. The tendering of fire-fighting and fire-alarm system and LAN are under progress. The work order for the interior works is to be placed shortly.

An amount of Rs.320.18 lakhs has been paid to the agencies and consultants regarding the subject work.

Major Renovation of the New Guest House and Research Scholars' Hostel and ISEC Hostel

The renovation work of the New Guest House was taken up during this financial year. The work considered the overall repair and painting of the rooms and bathrooms. The tiles and sanitary-plumbing fixtures of the bathrooms were completely replaced and the entrance lobby upgraded.

The total exterior plastering of the building has been removed, re-plastered and painted. An amount of Rs.34.36 lakhs expended for side renovation work.

The renovation work of the Research Scholars' Hostel and ISEC Hostel was completed during this financial year. The work considered the overall internal repair and painting of the rooms, verandahs and bathrooms. The tiles and sanitary-plumbing fixtures of the bathrooms were completely changed. The dining halls of both the hostels have been upgraded to provide more efficient area management. An amount of Rs.55.53 lakhs has expended for said renovation work.

Delhi

Land and Construction

During the financial year 2010-2011, one Works Advisory Committee meeting was held on 17.01.2011.

A write up on major construction activities during the period April 01, 2010 to March 31, 2010 at ISI Delhi Centre.

Following construction activities took place:-

1. Construction of Platinum Jubilee Hostel completed.
2. Construction of students' mess (work in progress).
3. Construction of jogging track.
4. Repair / renovation of old Hostel.
5. Repair of Street light.
6. Development of children's park (work in progress).
7. Plaster painting of outer wall of ISI Building.

A. Total expenditure incurred Rs.155.00 lakhs (approximately).
B. Construction of ICGP Office (Externally funded project).
C. Total expenditure incurred Rs.18.50 lakhs approximately.

Bangalore

During the year 2010-2011, the following activities were taken up at Bangalore Centre.

A – Construction:

1. Construction of 2nd floor of B. Math. Hostel was completed and the floor will be used for newly enrolled B. Math. students in the academic year 2011- 2012.
2. Painting and repair works of all the buildings of the campus were mostly completed.
3. The revised drawing, estimate and draft tender document for proposed Research Scholar Hostel were prepared by the Architect and will be submitted for the approval of WAC meeting scheduled to be held on 27th May, 2011.

Society Type Activities

Membership: April 2010 – March 2011

1) During the period 39 persons became Ordinary Members of the Institute.
2) 44 Ordinary Members became Life Members of the Institute.

The membership position as on 31 March, 2011 is as follows:

Ordinary Members	-	641
Life Members	-	913
Institutional Members	-	03
Total	-	1557

Finance Committee Meetings: The Finance Committee met twice on 10th September, 2010 and 8th October, 2010. Besides the decisions taken on various financial matters, the Finance Committee recommended RE 2010-11 and BE 2011-12 (both Plan and Non-Plan) in its meeting held on 10th September, 2010. The Annual Report including Audited Statement of Accounts for the year 2009-2010 was considered and recommended in the meeting of the Finance Committee held on 8th October, 2010.

Council Meetings: During the period under report (2010-11), the Council met six times on 12th June, 2010, 12th September, 2010, 24th September, 2010, 27th October, 2010, 15th January, 2011 and 28th March, 2011 to take decisions on various academic and administrative matters of the Institute. The Budget Proposals of the Institute both for Plan and Non-Plan (RE for 2010-11 and BE for 2011-12)

were considered in the meetings of the Council held on 12th September, 2010, as recommended by the Finance Committee in its meeting held on 10th September, 2010. The Annual Report including the Audited Statement of Accounts for the year 2009-2010 was considered and approved by the Council in its meeting held on 27th October, 2010.

A list containing the names of the President of the Institute, Chairman and members of the Council of the Institute and lists of members of different committees constituted by the Council are given in the Back Cover page and in Chapter 12 respectively.

Annual General Meetings: During the period under report (2010-11), the General Body of the Institute met on 26th November, 2010. The Annual Report of the Institute for the year 2009-2010 and Audited Statement of Accounts for the year 2009-2010 together with the Auditor's comments and replies of the Administration thereto were adopted in the meeting of the General Body held on 26th November, 2010.

11. LIST OF MEMBERS OF THE ACADEMIC COUNCIL AND OTHER COMMITTEES OF THE INSTITUTE AS ON 31 MARCH 2011

Academic Council

Bimal K. Roy, Director (Chairman)

B.P. Sinha, Dean of Studies (Convener)

Theoretical Statistics and Mathematics Division

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