

INDIAN STATISTICAL INSTITUTE

FORTYEIGHTH ANNUAL REPORT

April 1979—March 1980



208 Barrackpore Trunk Road
CALCUTTA 700 035

STATISTICAL INSTITUTE
abimal Dutt, ICS (Retd.)

a Council
M.Sc., Bar-at-Law, IFS (Retd.)
Government of India (4)

Central Statistical Organisation, Department of
Shri N. K. Panda, Joint Secretary, Ministry of
Finance, Department of Expenditure. 4. (iii) Dr. (Mrs.) A. R. Rajeshwari, Principal
Scientific Officer, Department of Science and Technology. 5. (iv) Shri V. V. Divatia,
Executive Director, Reserve Bank of India (Shri K. P. N. Nair, Department of Statistics,
Reserve Bank of India, from 3 August 1979).

Scientists not employed in the Institute (7)
Representatives of ICSSR (1) 6. Professor Bhabatosh Dutta
Representatives of INSA (4)

7. (i) Professor M. S. Narasimhan, School of Mathematics, Tata Institute of Funda-
mental Research, Bombay. 8. (ii) Professor S. S. Shrikhande. 9. (iii) Professor B. K.
Bachhavat, Director, Indian Institute of Experimental Medicine, Calcutta. 10. (iv) Dr. S. C.
Bhattacharyya, Director, Bose Institute, Calcutta.

Scientists co-opted by the Council (2)

11. (i) Professor R. P. Bambah, Department of Mathematics, Centre for Advanced
Studies in Mathematics, Punjab University. 12. (ii) Dr. R. Narasimhan, Head, Computer
Group, Tata Institute of Fundamental Research, Bombay (Professor V. Rajaraman, Com-
puter Centre, Indian Institute of Technology, Kanpur, from 3 August 1979).

Elected representatives of the Institute
Members not employed in the Institute (2)

13. (i) Dr. P. K. Bose, M.Sc., Ph.D., FSS (London), Head, Department of Statistics,
University of Calcutta. 14. (ii) Dr. P. V. Sukhatme, M.A., Ph.D., F.N.A., Honorary
Professor of Biometry, Maharashtra Association for Cultivation of Science.

Elected representatives of the employees of the Institute (2)

15. (i) Dr. (Mrs.) K. Saradamoni, Senior Lecturer. 16. (ii) Shri Kamalendu
Bhattacharya, Section Officer.

Officers of the Institute (ex-officio) (9)

17. (i) Director

Professor-in-Charge of Scientific Division (5)

18. (ii) Dr. Asok Maitra, Professor, Theoretical Statistics & Mathematics. 19. (iii)
Shri Dobbas Chaudhuri, Applied Statistics, Surveys & Computing Division. 20. (iv) Dr.
Asok Rudra, Professor, Social Sciences Division (Dr. N. Bhattacharya, from 19 July 1979).
21. (v) Dr. Ambarish Ghosh, Professor, Physical and Earth Sciences Division. 22. (vi) Dr.
Kaanti Bhusan Pakrasi, Biological Sciences Division. 23. (vii) Shri C. R. Prasad, Head of
Statistics Quality Control and Operations Research Division. 24. (viii) Dr. S. K. Mitra, Head,
Delhi Centre (Dr. K. R. Parthasarathy from 6 November 1979). 25. (ix) Dr. T. Krishnan,
Dean of Studies. Shri N. Srinivasan, Officer-on-Special Duty, actodes non-member Secretary.

LIST OF MEMBERS OF DIFFERENT COMMITTEES

1. Finance Committee of the Council :

(1) Director of the Indian Statistical Institute or his nominee (ex-officio Chairman).
(2) Dr. P. K. Bose, Head, Department of Statistics, University of Calcutta. (3) Dr. Bhabatosh
Dutta. (4) Dr. B. P. Adhikari. (5) Dr. J. Roy. (6) Shri S. M. Sundara Raju. (7) Dr. S. K.
Mitra (Dr. K. R. Parthasarathy from 6 November 1979). (8) Dr. K. B. Pakrasi. (9) Dr.
Ambarish Ghosh. (10) & (11) Two representatives nominated by the Government of India
(Dr. K. C. Saha, Director, C.S.O. and Sri N. K. Panda, Joint Secretary, Department of
Expenditure, Ministry of Finance). (12) Shri P. K. Chatterjee, Senior Accounts Officer,
Indian Statistical Institute (non-Member Secretary).

2. Examinations Committee :

1. Dr. P. K. Bose, Head, Department of Statistics, University of Calcutta; 2. Professor
H. K. Nandi, Department of Statistics, University of Calcutta; 3. Professor A. M. Goom,
of College, Department of Statistics; 4. Professor T. V. Abadhani, University of
5. Dr. T. P. Abraham, Additional Director, C.S.O., Ministry of Planning, Govern-
ment of India; 6. Dean of Studies, Indian Statistical Institute; 7. Dr. B. Ramachandran;
8. Dr. K. R. Parthasarathy; 9. Dr. K. R. Parthasarathy; 10. Shri P. K. Maitra, Secretary-Convenor.

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5. Dr. T. P. Abraham, Additional Director, C.S.O., Ministry of Planning, Govern-
ment of India; 6. Dean of Studies, Indian Statistical Institute; 7. Dr. B. Ramachandran;
8. Dr. K. R. Parthasarathy; 9. Dr. K. R. Parthasarathy; 10. Shri P. K. Maitra, Secretary-Convenor.

REFERENCE BOOK

(Not to be taken out of the Library)

INDIAN STATISTICAL INSTITUTE

FORTYEIGHTH ANNUAL REPORT

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Part I. Teaching, Training, Research, Projects and Publications

I. TEACHING AND TRAINING

Degree and Training Courses : 6,331 candidates applied for admission to the B.Stat. and M.Stat. degree courses, post-M.A./M.Sc. diploma courses and research scholarships and took special admission tests at 12 centres in different parts of the country for primary selection. The candidates appeared for interviews and the final selection at Calcutta. Special admission tests were also held for admission to the (1) Evening Course in Statistics at Calcutta and Delhi. (2) One-year Certificate Course in Data Collection and Processing Methods, (3) Two-year Advanced Diploma Course in Computer Science, (4) Course on Operation of Punched Card Machines, and (5) Two-year, part-time Diploma Course in SQC and OR, Bombay and Madras. The annual examinations of the B.Stat. and M.Stat. courses were held in May-June 1979. The 1979-80 academic year commenced on 1 August 1979.

The Fourteenth Convocation of the Institute was held on 25 April 1980. One hundred fourteen candidates received degrees and diplomas on the occasion.

The following is a list of the number of candidates admitted to the different degree and training courses during 1978-79 and 1979-80 and the number who passed in the annual examinations in 1979.

	<i>Number of students</i>		<i>Number passed in Annual Examination in 1979</i>
	1978-79	1979-80	
1. Courses leading to a Degree in Statistics :			
1.1 Bachelor of Statistics with Honours—			
B.Stat. (Hons.)			
1st year	...	14	29
2nd year	...	13	13
3rd year	...	15	15
4th year	...	17	15
1.2 Master of Statistics (M.Stat.)			
<i>Previous Year</i>			
(i) Calcutta	...	16	} = 23
(ii) Delhi	...	7	
			} = 14
<i>Final Year</i>			
(i) Calcutta	...	22	} = 28
(ii) Delhi	...	6	
			} = 26
			} = 27

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	Number of students		Number passed in Annual Examination in 1979
	1978-79	1979-80	
1.3 Junior and Senior Research Fellows, Visiting Fellows*	98	107	—
2. Specialised Courses in Applied Statistics leading to Diplomas:			
2.1 Statistical Quality Control and Operations Research	18	21	13
3. Courses in Statistics for Persons in Employment (jointly with the CSO):			
3.1 Junior Certificate Course in Statistics	13	13	13
3.2 Indian Statistical Service Probationers Training Course ...	18	—	18
4. Evening Courses:			
4.1 Statistical Methods and Applications (One-Year)			
(i) Calcutta	44	46	9
(ii) Delhi	39	12	14
4.2 Two-year Post-Graduate Diploma in Statistical Quality Control and Operations Research (Bombay & Madras):			
4.2.1 (i) Bombay—1st year ...	15	17	11
(ii) Bombay—2nd year ...	6	5	4
4.2.2 (i) Madras—1st year ...	30	28	14
(ii) Madras—2nd year ...	11	14	11
4.3 Six-month Evening Course in Statistical Quality Control at Bangalore			
(i) July to December ...	30	31	23
(ii) January to June ...	11	18	14
5. Electronic Computer Courses:			
5.1 Two-year Advanced Diploma in Computer Science	21	29	12
5.2 One-year Certificate Course in Data Collection and Processing Methods ...	9	5	3
5.3 Intensive Course on Programming and Applications	27	23	27
5.4 Course on Operation of Punched Card Machines	13	17	12
	<hr/> 513	<hr/> 506	<hr/> 302
	—	—	—

* including Delhi Centre.

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2. INTERNATIONAL STATISTICAL EDUCATION CENTRE (ISEC), CALCUTTA

The International Statistical Education Centre (ISEC) started in 1960, is operated jointly by the International Statistical Institute and the Indian Statistical Institute, under the auspices of the UNESCO and the Government of India. During the year, the Centre functioned under a joint Board of Directors, consisting of: *Chairman* : Professor C. R. Rao, *Members* : J. M. Gani and E. Lunenberg (ex-officio members representing the International Statistical Institute), N. K. Mukherjee (Cabinet Secretary, representing the Government of India), G. Kallianpur and N. Bhattacharya (*Member-Secretary*) (representing the Indian Statistical Institute).

During the year, the Centre conducted the Regular Course in Statistics, Thirty-third Term, with 26 trainees from 14 countries in South and South-East Asia, the Far East, and Commonwealth Africa. The Government of India awarded 16 fellowships for the foreign trainees attending the Regular Course—11 under the Technical Cooperation Scheme of the Colombo Plan and 5 under the Special Commonwealth African Assistance Plan (SCAAP). Four foreign trainees were granted CFTC fellowship. Four Indian trainees and 2 trainees from Sri Lanka were supported by their governments. The ten-month Regular Course was started on 1 June 1979. The programme of training followed the same pattern as in previous years.

In addition to the above, eight trainees attended (for completed) Special Courses in various fields during the year. One trainee from Uganda completed a six-month Special Course in Sample Survey and Data Processing (with emphasis on Educational Statistics and Educational Planning) in June 1979. Two trainees from Zambia underwent a five-month Special Course in Mathematical Statistics during April–August 1979; two trainees from Bangladesh attended Special Courses during April–June 1979, one in National Income Statistics and the other in Industrial Statistics; and one trainee from Japan attended a one-year Special Course in Economic Statistics for planning during April 1979–March 1980. One trainee from Nigeria underwent a three-month course in Computer Programming, Systems Analysis and Design during October 1979–January 1980. One trainee from Vietnam attended a six-month course in Mathematical Statistics during September 1979–March 1980. The Zambian trainees were supported by SCAP fellowships and the Bangladeshi trainees by CFTC fellowships. The trainee from Uganda was under a UNESCO fellowship and the trainee from Vietnam was supported by his employer, viz. ESCAP (Mekong Committee). The remaining two were supported by their employer/government.

Professor J. M. Gani, Chairman, Statistical Education Committee, International Statistical Institute, visited the Centre on 14–16 November 1979. Discussions were held during his visit on various measures needed for improving the training activities of the Centre. Based on Professor Gani's report regarding his visit, the Statistical Education Committee, International Statistical Institute, recommended certain steps for making the ISEC programmes more effective. There being general agreement on these measures, it is intended to implement them in the next few years.

3. PROFESSIONAL EXAMINATIONS IN STATISTICS

Conducting Professional Examinations in Statistics for external candidates on an all-India basis has been an important activity of the Institute, since 1938. These examina-

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tions are based on well-organised syllabi to reach high professional standards and lead to certificates and diplomas.

During the period, examinations for the Statistical Assistantship Certificate and Junior & Senior Diploma in Statistics were held at the Centres in Bangalore, Bombay, Calcutta, Delhi, Hyderabad, Lucknow and Madras for both May and November terms.

The details regarding the candidates who registered, appeared and passed in one or more papers of these examinations during the May and November (1979-80) terms are given below :

Examination	Number of candidates					
	registered		appeared		passed*	
	May	Nov.	May	Nov.	May	Nov.
(i) Statistical Assistantship Certificate	18	19	14	13	8	5
(ii) Junior Diploma in Statistics	44	65	24	38	6	12
(iii) Senior Diploma in Statistics	30	16	26	14	11	7

Six candidates who passed in all the papers during the year were awarded the Statisticians' Diploma at the Fourteenth Convocation of the Institute held on 25 April 1980.

The total number of candidates who have qualified for the award of Certificates and Diploma in the professional examinations in statistics conducted by the Institute upto the end of March 1980 are 457 and 222 respectively.

II. THEORETICAL STATISTICS AND MATHEMATICS

2.1 Calcutta

2.1.1 Research problems in various disciplines of pure mathematics and mathematical statistics were dealt with. The list of published papers and other technical reports in various stages of processing give a more detailed idea of the work done. During the period, research was conducted in the following areas: Stochastic processes and control theory, probabilistic number theory, Ergodic theory, optimal stopping problems, asymptotic theory in statistics, multivariate analysis, statistical inference, sequential analysis, decision theory, inference in stochastic processes, sampling theory, design of experiments, combinatorial mathematics and graph theory, descriptive set theory, measure theory, functional analysis, harmonic analysis and algebraic topology, algebra, topological automata, probability theory, probabilities of deviations, non-linear prediction, pattern recognition, and sediment transport problems.

During the year, 24 research papers were published, 29 papers have been accepted for publication and 46 papers have been submitted for publication.

* in one or more papers—not necessarily completed the examination.

2.2 Delhi

Work was carried out in linear statistical (models) and inference and related linear algebra, inference in stochastic processes, Laplace transforms as applied to integral equations in probability theory, quantum mechanics, operator theory (perturbations), queuing and reliability theory, stochastic games and selection theorems.

The number of research papers published during the year is 5. 3 papers have been submitted for publication. One paper was presented in a conference.

2.3 Bangalore

Research was conducted in the following areas: inference in stochastic processes, Ergodic theory, non-standard analysis, reliability theory, branching processes, random probability measures, rates of convergence in limit theorems, statistical mechanics, optimal control and the application in biomathematics.

Papers published: 3; papers sent for publication: 5; papers presented at conferences: 1; books reviewed: 2; books sent for publication: 1; technical reports: 7.

III. APPLIED STATISTICS, SURVEYS AND COMPUTING

3.1 The Division of Applied Statistics, Surveys and Computing has a Divisional Committee of Scientific Workers (DCSW) and a Technical Advisory Committee (TAC) which came into existence during the year 1976-77, with the adoption of the new constitution of the Indian Statistical Institute. The DCSW met thrice during the year to formulate proposals for research and developmental programmes. The TAC met once to finalise the annual programmes and budget for the year 1980-81.

3.2 *Teaching and Training:* The Division organised the undermentioned courses:

3.2.1 *Advanced Diploma in Computer Science:* Nine students were in the second year of the course during 1979-80. Sixteen students were admitted to the course for the session 1979-80.

3.2.2 *M.Stat. (Final year) Course in Applied Statistics and Data Analysis:* Six students successfully completed the course during the year 1978-79. The course for the session 1979-80 was organised by the Dean of Studies.

3.2.3 *Course in Operation of Punched Card Machines:* Thirteen students completed successfully the course in 1978-79. Eighteen students were admitted in the 1979-80 session.

3.2.4 *Intensive Course on Programming and Application of Electronic Computers (15th session: 15 October 1976-22 December 1979):* The objective of the course was to impart basic knowledge of how a computer is used in solving problems. The course covered use of unit record machines, programming in FORTRAN, selected numerical techniques and fundamentals of computer organisation. All the 22 trainees including one student from ISEC were awarded Certificates of Merit. Most of them were sponsored by various Government departments, public sector enterprises, educational and research institutions. Special lectures on programming techniques were arranged. In order to expose participants to different types of computers, visits were arranged to organisations like the Dunlop India Ltd., Variable Energy Cyclotron Project and the Bengal Engineering College.

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3.2.5 *One-year Certificate Course in Data Collection and Processing Methods*: Three students successfully completed the course during the 1978-79 session. Two students were admitted in the 1979-80 session.

3.3 *Research*: Research is carried out both in the field of theoretical investigation of methodology and application of the existing methods to the solution of practical problems with social relevance.

The main areas of research work in the Division are: sample surveys, multivariate analysis, design of experiments, computer software, systems simulation in planning sampling strategies, particularly for surveys on successive occasions, the estimation of variance of a finite population under some super population set up and on choice of sample size for Horvitz Thompson estimation. In multivariate analysis and related areas, studies are in progress on generalised inverses, clustering problems and testing problems under violations of standard assumptions and mixed model analysis. Studies in factorial experiments, robustness and search theory have yielded encouraging results. The development of computer software systems for the Population Data Base (National Population Register) and analysis of survey and census data are the areas of study in computer software. A study on the behaviour and control of environmental and biological systems is under way, using computer simulation.

24 Papers were published, 12 papers were accepted for publication, and 18 papers submitted for publication.

3.4 *Seminars*: Twentyeight seminars and colloquiums were organised.

3.5 *Project Work*: The analysis of data in connexion with Health and Socio-economic Survey in the CMDA area conducted by the CMDA has been completed. In this connexion, about 1.5 lakhs of cards were processed, and 300 tables produced.

On request from Central Mine Planning and Design Institute, packages are being developed for the analysis of geological data involving contour mapping, evaluation of various geological parameters, and cross section of mines. Part of the project has been completed.

3.6 *In-House Computer System*: The Divisional Computer Centre maintains two computer systems: (i) EC-1033 System; (ii) V-77/300 Varian Computer System.

3.7 *Symposium*: A Symposium on Advanced Methods of Data Collection, Validation, Storage, Retrieval and Analysis, 17-20 January 1980, was organised by the Division at the ISI, Calcutta.

3.8 *Training*: Seven persons underwent training in a course on Operation of EC-1033 System during February-March 1980 conducted by the ELOG company. Two engineers joined the Division as trainees.

Sarvasri K. Rajgopal, Anirban Basu, and Subrata Dutta were sent to the USSR for training on EC-1033 system hardware.

IV. PHYSICAL AND EARTH SCIENCES

4.1 *Chemistry*

Studies on the distribution and characterisation of organic matter present in West Bengal Soils : In connexion with these studies, over 250 soil samples have been collected so far. Nitrogen, carbon and phosphorous have been determined. Humic, fulvic and humatonalamic acid fractions of the organic matter of about 50 samples were determined. Amino acid, phenolic and sugar constituents of the humic fraction of over a dozen soil samples were identified and their quantities estimated.

Two papers were sent for publication and two papers read at conferences.

4.2 *Electronics*

Research is being conducted in the undermentioned areas :

4.2.1 *Theoretical Physics :* (i) Elementary particles, (ii) Gravitation and cosmology, (iii) Solid state physics, (iv) Plasma physics, (v) Measurement problem.

4.2.2 *Physics of fluids :*

- (i) Flow analysis in hydroclone separators
- (ii) Phenomenon of sediment transportation
- (iii) Opposed jet problem
- (iv) Statistical theory of turbulence
- (v) Two-phase flow problems
- (vi) Linear and non-linear stability analysis.

4.2.3 *Digital electronics :*

- (i) Development of a microprocessor based system
- (ii) Design and development of a signal processing system
- (iii) Computer system (fault tolerant computing, microprogramming, graph theory, switching theory, physical design problem).

4.2.4 *Flume projects :* The following mathematical and statistical problems concerning transportation and deposition of sediments by running water were studied by a team consisting of a geologist, a statistician and a mathematician.

(i) The efficiency of a new formula for computation of bed load and suspended load, developed last year in modification of Hunt's method, was test during the current year. This formula, as well as a simplification based on Rouse's equation, was found suitable. The latter was used for some theoretical studies on grain-size distributions of bed and suspension.

(ii) The error due to sampling of bed and suspension materials for each grain-size was investigated.

(iii) Preparations were made for conducting flume experiments on deposition from suspension at decelerating velocity.

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Eighteen papers were published in scientific journals, 32 papers accepted/submitted for publication, and 9 papers read at conferences/published in conference proceedings. Thirteen technical reports were prepared.

4.3 *Electronics and Communication Science :*

The research activities of the Electronics and Communication Science Unit may be grouped under the following heads. The results of theoretical and experimental investigations are published regularly in scientific journals in India and abroad.

4.3.1 *System theoretic approach in neural modelling and simulation :* Different experimental neural models were constructed and properties of single neuron and interconnected neurons, as in random net, are being studied.

4.3.2 *Associative memory system :* Theoretical work is in progress on the model study of associative memory systems for time-varying spatial patterns along with the application in relational Data Base Management Systems.

4.3.3 *Digital Signal processing and transform coding techniques :* Research is in progress on microprocessor based bio-signal processing.

4.3.4 *Optical and digital data communication :* Investigations on the wave propagation through optical fibres were extended to anisotropic material guides with their usefulness to Laser cavity design, and mode filter design.

4.3.5 *Pattern recognition :* Research and development work is concerned with problems of man-machine communication, bio-medical applications, natural resources estimation, detection of crimes and criminals, and scientific and military applications.

Mathematical models developed so far include : (a) Statistical decision theoretic approach, (b) Syntactic approach, and (c) Fuzzy set theoretic approach.

4.3.6 *Image analysis and image understanding system :* A detailed study has been undertaken of scene analysis and image understanding system.

4.3.7 *Speech sound analysis and speaker identification :* (i) Vocabulary for the study of acoustic phonetic properties of Bengali speech sounds, (ii) Acquisition of speech samples, (iii) System design for fast computerised analysis of speech sounds, using Sonagraph and Microprocessor, (iv) A microprocessor based speech synthesizer for synthesis of vowel sound is being experimented upon.

4.3.8 *Cybernetics and system theory :* (i) Investigation on the general and cybernetic system theoretic approach to the problems of environmental planning, applying pattern recognition, machine learning and image analysis techniques.

Training programme : Fifteen post-graduate students from the Banaras Hindu University, Calcutta University, Jadavpur University, Sibpur B.E. College, and I.I.T., Kharagpur, received practical training in Advanced Digital Systems.

Twentyfive papers were published in scientific journals, 12 papers sent for publication and 7 papers read at conferences/published in conference proceedings. Two books were published.

4.4 *Geology :*

A. The integrated programme of geological research was continued in the Pranhita-Godavari Valley. The main topics of research were : (i) Osteology of *Barapasaurus* *laporei*, a Lower Jurassic Sauropod dinosaur from India, (ii) Missing link dinosaur from India, (iii) Sauropoid reptiles from the Yerrapalli formation, (iv) Excavation and exploration of theorepoid reptiles from Yerrapalli formation, (v) Review of the continental Lower Jurassic fauna from Kota formation, (vi) Examination of spirally-coiled coprolites from Malori formation, (vii) Study of a dinosaur braincase from Upper Cretaceous formation, India, (viii) Study of Permian vertebrate fauna, (ix) Examination of the fauna of Late Upper Triassic Dharmaram formation, (x) New coeuchian reptile from the Late Triassic of India, (xi) New cynodont from the Triassic of India, (xii) Reconnaissance survey of the area around Chinur, A.P., (xiii) Flora of Gangapur formation (in collaboration with Birbal Sahni Institute of Palaeobotany), (xiv) Geology of the area around Yamanpalli-Lingal-Motpalli in Adilabad district, A.P., with special reference to Lower Jurassic Kota carbonates, (xv) Study of limo pellet rocks in the continental red bed sequence of the Upper Gondwanas, (xvi) Pro-cambrian life and Proterozoic sedimentation in Pranhita-Godavari Valley, (xvii) Study of carbonate tidal flat sequence near Ramgundem, A.P., (xviii) Study of Proterozoic rocks of Pranhita-Godavari valley (Pakhal Group) and central Rajasthan (Delhi Group).

B. *Recent Fluvial Studies :* Sedimentological studies of the present-day fluvial deposits in the Uari river around Giridih, Bihar, were continued with a view to obtaining clues to the condition of deposition of ancient fluvialite sediment. The nature of lithologic contact between the arenaceous point bar deposits and the aggrillaceous overbank deposits were studied in detail.

A new technique was developed in collaboration with statisticians for the analysis of weight frequency (sieve) data.

Published papers : 3 ; Papers sent for publication : 6.

4.5 *Physics :*

(i) Studies in human biomechanics, particularly the mechanical properties of various human tissue and organs, normal as well as pathological.

(ii) Applications of Control Theory to electrical mechanics and power systems.

(iii) Interaction of physics and medicine.

Papers published : 4; papers sent for publication : 2; papers read at conferences/published in conference proceedings : 2.

V. BIOLOGICAL SCIENCES

5.1 *Anthropometry and Human Genetics*

5.1.1 Research was conducted in the following areas :

(i) Biosocial studies of the Kaoras, a backward scheduled caste of West Bengal.

(ii) Pattern of fertility and reproductive wastage by parity and social class.

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- (iii) Physical growth of Bengali school-going boys during last 50 years.
- (iv) Micro-evolutionary dynamics among Mahars of Maharashtra.
- (v) Fertility, sex-ratio and bio-chemical genetic markers (in collaboration with RKM Hospital, Calcutta).
- (vi) Indo-Soviet Anthropogenetic Survey 1979 (in collaboration with USSR: Academy of Sciences).
- (vii) Placental enzyme polymorphism in Indian populations.
- (viii) Bio-anthropological study of Nandiwallas.
- (ix) Bio-anthropological study of a migrant African group—the Sidhis of India.
- (x) Genetics of finger and palmar dermatoglyphics.
- (xi) Impact of ecology on human population structure.
- (xii) Impact of attitude on human population.
- (xiii) Relationship between socio-economic condition, nutrition and health in a Mahishya population sample.
- (xiv) Biomedical study of Portuguese descendants of Mirpur village, Midnapore, West Bengal.
- (xv) Human chromosomes.
- (xvi) Dietary pattern, body measurements, parasitic load, and other health indicators among the inmates of two old-age homes in Calcutta city.
- (xvii) Standardization of laboratory techniques in biochemical polymorphism.
- (xviii) Genetic variation among the local population of North Sikkim.

5.1.2 Scientific papers published : 2; papers sent for publication : 16; papers read at conferences/published in conference proceedings : 16; books published : 1; articles published in books : 6; technical notes : 9.

5.2 Biochemistry :

5.2.1 Areas of study are as follows :

- (i) Inorganic pyrophosphatase from green leaves.
- (ii) Correlation of cyanomethaemoglobin and oxyhaemoglobin levels in adult human being.
- (iii) Survey of medicinal plants in north West Bengal.
- (iv) Dietary intake pattern, body measurement, parasitic load and other health indicators among the inmates of two old-age homes in Calcutta city.
- (v) Impact of altitude on human population.
- (vi) Relationship between socio-economic condition, nutrition and health (the last three research projects were conducted in collaboration with the Anthropometry and Human Genetics Unit).

5.2.2 Paper published : 1; papers sent for publication : 2; papers read at conferences/published in conference proceedings : 3; technical notes : 2.

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5.3 Botany :

5.3.1 Work was done in the following areas :

(i) Breeding of rice and performance trial of a dual-purpose, high-yielding (with grain and straw) rice variety developed by the Botany Unit.

(ii) Performance trials of varietal mixtures of rice, wheat, oat etc. and of species mixtures of cereals and legumes like wheat and gram, wheat and pea, rice and pigeon pea, oat and gram, oat and lentil were carried out at the ISI experimental farm.

(iii) The mechanisms of biological competition and interactions and the effects of electromagnetic field on the mitotic behaviour of plants.

5.3.2 The final report on the survey on costs and benefits of rural electrification was completed by Dr. J. Roy and Professor S. K. Pal (Applied Statistics Division) and Professor S. K. Roy of Botany Unit.

5.3.3 The editing and publication of the Proceedings, Forty-first Session, International Statistical Institute, New Delhi, 5-16 December 1977, was completed by Professor S. K. Roy.

5.4 Crop Science

5.4.1 Studies carried out are as follows :

- (i) Lovo- and dextro-rotatory phenomenon occurring in plants and animals.
- (ii) Exploratory work on the family Araceae (Palmae).
- (iii) Application of mathematics to biology.

Papers published : 5; papers sent for publication : 2.

5.5 Embryology

5.5.1 The following studies were carried out :

- (i) Molecular embryology of molluscan eggs.
- (ii) Ecological and biochemical study of wild life.
- (iii) Biomathematical study in transcription and translation during embryogenesis.

Papers published : 4; papers sent for publication : 3; papers read at conferences/published in conference proceedings : 4; articles published in books : 1.

5.6 Leaf Protein

5.6.1 Work was done in following areas :

- (i) Screening of local land and aquatic plants.
- (ii) Agronomic aspects : Three root crops, viz., radish, turnip and beetroot are being studied in a series of long-term experiments.
- (iii) Microbiological aspects : Work on deproteinized fluid or whey (microbial load study, propagation of common yeast in deproteinized whey from different species fuse of whey from cruciferous species for lipase production).

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(iv) *Biochemical and nutritional aspects*: Work has also started on the other by-product i.e., fibre, determination of percentage of polar lipids present in different fractions during L.P.C. production, and utilisation of water hyacinth.

Papers published : 5; papers sent for publication : 5; papers read at conferences : 7.

VI. SOCIAL SCIENCES

6.1 Demography

6.1.1 Studies made during the year pertain to :

- (i) Fertility and family planning survey in villages of districts around Calcutta, 1977-79 (Education development in rural West Bengal; Two generation education mobility of males; Non-enrolment of children in schools and reporting error in data collection; Household in villages of West Bengal).
- (ii) Migration survey in villages of districts around Calcutta, 1979-80.
- (iii) Health survey in villages of districts around Calcutta, 1979-80.
- (iv) Evaluation of family planning acceptance in villages of Murshidabad, Nadia and Birbhum districts, 1980.
- (v) Ideal age of marriage for boys and girls.
- (vi) Nuptiality estimates for India.
- (vii) Intergenerational fertility.
- (viii) Population estimates for India.
- (ix) Construction of life table.
- (x) Nuptiality estimates in ESCAP countries.
- (xi) Effects of econo-demographic factors on fertility.
- (xii) Environmental and social factors as causation of rural-urban mortality difference in India.
- (xiii) Classification of Indian districts on the basis of their socio-economic and demographic differences.
- (xiv) A model female working force table.
- (xv) Centenarians in India.

6.1.2 Teaching

6.1.2.1 Besides teaching for the degree courses, the staff of the Demography Unit imparted training in the following programmes :

- (i) Specialised training in vital statistics and demography for five statistical officer trainees.
- (ii) Specialised training in demography for five trainees of the International Statistical Education Centre.

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6.1.3 One workshop on School Enrolment data collection, organised on 23 October 1979, was attended by scientists from the units in Anthropometry, Psychometry, and Applied Statistics.

6.1.4 Papers published : 5; papers sent for publication : 2; papers read at conferences/ published in proceedings : 6; articles published in books : 4; Technical Reports : 9.

6.2 Research in economics and econometrics

6.2.1 Research in economics and econometrics was conducted in Calcutta, and at the Bangalore and Delhi Centres of the Institute.

6.2.2 Calcutta :

6.2.2.1 The research activities of the Economic Research Unit (ERU), Calcutta, conducted on a continuing and regular basis, covered a wide range of problems which included studies on applied economics, and planning and theoretical/methodological studies in economics and econometrics.

6.2.2.2 A brief account of the progress of research projects is given below :

(a) *Studies in Economic Theory* : Research was conducted along the following lines : (i) the basic theory of production; (ii) the logical structure of the classical concepts of value, distribution and accumulation and of production and circulation; (iii) the relational structure of backward agriculture and its implications; (iv) micro-economic problems; and (v) conceptual issues relating to the relevance of the unit or sectors specific "production function" as an analytical tool in the context of the Leontief input-output model.

(b) *Studies in Econometric Methods* : Various statistical problems arising in the estimation of single equation linear regressive models were examined.

(c) *Studies on measurement of poverty/inequality and income distributions* : A number of conceptual issues related to the definition and measurement of poverty and inequality in income distributions were considered and generalisations proposed.

(d) *Planning* : A number of problems in planning were studied during the year. These include (i) evolving a policy for rational utilisation of energy resources with particular reference to nuclear power in India; (ii) formulation of a concept of 'basic needs' as a means of assessing development performance; (iii) certain aspects of regional and spatial planning in India.

(e) *Applied Economic problems*

(i) *Studies on Rural Economy* : The field work of the project on the potentialities of rural development was completed in a cluster of 4 villages in Bankura district.

(ii) *Socio-economic enquiries on labour* : The material collected in the Haldia Labour enquiry was tabulated and the relevant report is nearing completion. The survey of the unorganised transport workers in Calcutta, sponsored by the Indian Council of Social Science Research, was completed.

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(iii) *Survey in Integrated Rural Development Block*: A household survey in two Integrated Rural Development Blocks was undertaken at the request of the West Bengal Government. The preliminary work relating to the survey has been completed.

(iv) *Evaluation of the programme of distribution of miniflits*: At the request of the West Bengal Government, the evaluation of the programme of distribution of miniflits among the flood and drought affected farmers in West Bengal was undertaken.

(v) *Studies in consumer behaviour*: A number of theoretical and empirical studies concerned with the analysis of consumer behaviour were undertaken.

(vi) *Studies on disparities in the level of living*: Various studies are in progress on inter-regional disparities in the level of living in India on the basis of N.S.S. eighteenth and twentieth round household budget data.

(vii) *Agriculture*: Some studies for Indian agriculture completed/undertaken include evolution of the agrarian structure of Bengal during 1920-47, and a comparative study of the evolution of rural economy of West Bengal, Tamil Nadu, Punjab and Haryana since 1961.

(viii) *Industry*: A study is in progress on the measurement of productivity in selected manufacturing industries, using ASI data since the mid-sixties.

(ix) *Foreign trade*: Some further work on India's export performance since the mid-sixties was carried out.

6.2.2.3 The economists stationed in Calcutta had (i) Published papers : 13; (ii) Papers sent/accepted for publication : 13; (iii) Papers presented at conferences/published in conference proceedings : 21; (iv) technical reports/discussion papers : 8; (v) Books published : 1.

6.2.3 Delhi

6.2.3.1 The activities of the economists at the Delhi Centre are noted below :

Dr. L. S. Bhat supervised the work of two research students for Ph.D., registered at the Jawaharlal Nehru University. One of them was awarded the Ph.D.

Shri Prakash Chander is working on the theory of Decentralized Resource Allocation Mechanisms and Non-Linear Input-Output Models.

Dr. B. S. Minkas has been conducting research on two topics : (i) Growth poverty and basic needs : development policies in Sri Lanka, Kerala and Punjab, (ii) Inter-regional comparisons of agricultural growth and development in South Asia in the post-colonial period.

6.2.3.2 Thirty-two seminars/lectures by visiting scientists and staff members were organised at the Delhi Centre.

6.2.3.3 The statisticians and economists at the Delhi Centre had (i) published papers : 9; (ii) papers sent/accepted for publication : 8; (iii) papers presented at conferences/published in conference proceedings : 4; (iv) technical notes/discussion papers : 1; Books published : 1.

6.2.4 Bangalore

6.2.4.1 *Dr. N. S. Iyengar* continued his earlier investigations on the pattern of asset holdings in rural India and to search for appropriate models for analysing the Reserve Bank data on the distribution of household assets.

In collaboration with P. A. V. B. Swamy, Federal Reserve Board, USA, and J. B. Mehta, Temple University, USA, he completed a study of the finite sample properties of the limited information maximum likelihood estimator and developed a modified procedure which guarantees the existence of finite moments for the modified estimators.

Shri P. R. Nayak (now deceased) conducted research in economic theory and prepared an interesting paper on the advantages of discounting infinite utility streams.

6.2.4.2 Papers published : 1; papers sent for publication : 3; papers presented at conferences : 3; technical report : 1.

6.3 Linguistic Research

The research programme may be broadly grouped under the following :

6.3.1 The study of the phonetic structures of the major Indian languages and application in the areas of (i) Speech pathology : speech habilitation of hearing impaired children, (ii) Teaching of second language, and (iii) Cultivation of mother tongue.

Fundamental research is being conducted in the suprasegmentals of Bengali, Hindi, and Telegu phonetics. Studies were also conducted in fundamental and applied research, in collaboration with the Central Institute of Hindi, National Council for Educational Research and Training and the Universities of Delhi and Osmania, in the following areas :

Bengali phonetics : (a) Allophonic varieties of Bengali speech sounds; (b) Articulatory norms in school-going children; (c) Evaluation of articulation in hearing-impaired children.

Hindi phonetics : Preparation of methodological units for speech habilitation of hearing-impaired children with Hindi as mother tongue.

Telegu phonetics : Preparation of methodological units for speech habilitation of hearing-impaired children with Telegu as mother tongue.

Punjabi phonetics : The articulatory and acoustic phonetic structure of the Punjabi language was studied during the last three years. A book entitled, "A Short Outline of Punjabi Phonetics" by D. Kostic, A. Mittor and V. Narang (Central Institute of Hindi, Delhi) is being finalised for production.

English phonetics : A book entitled "Speech and the Hearing-Impaired Child" by D. Kostic was published in 1979-80. This work contains the basic principles and methodology for speech and language, habilitation of small, hearing-impaired children. The acoustic, phonetic structure of the English language has been described for the purpose of habilitation of speech, utilising the Kostic methodology and instrumentation.

6.3.2 Investigation of problems relating to the structure of meaning.

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6.3.3 A statistical approach to linguistic problems : Some statistical studies are in progress and others are planned on quantitative linguistic and phonetic data on the following languages : Bengali, Hindi, Telegu, Punjabi, Serbo Croat and English.

Professor Djordje Kostic, Scientific Adviser, Institute for Experimental Phonetics and Speech Pathology, Belgrade, and Visiting Professor, guided the research work and conducted seminars/discussions.

6.3.4 Publications :

- (i) Speech and the Hearing-Impaired Child by Djordje Kostic (pp. 204, Indian Statistical Institute, 1980).
- (ii) A Short Outline of Punjabi Phonetics by D. Kostic, Alokannada Mitter, Vaishna Narang (in preparation for publication).

6.3.5 Audiometric tests were conducted throughout the year on request from hospitals, schools, and clinics for the deaf.

6.4 National Income Research

6.4.1 Studies were continued on the distribution of income among industry occupations in various sectors of the economy. Several technical notes were prepared on the basis of the results of investigations covering occupations in Central Government services, agricultural operations, manufacturing industries, mining and plantation in India.

6.4.2 The study on the distribution of income and wage-differentials between different categories of occupations in West Bengal State Government services is now in an advanced stage.

6.4.3 Studies on national accounts with some emphasis on preparation of component tables on regional accounts for West Bengal were continued along with the calculations of indicators of development of various aspects of this State in accordance with the directions of the Committee on Regional Accounts. The first phase of the study culminated in preparing some of the standard tables (18 in all) for West Bengal by districts.

6.4.4 Almost all work on Engel curve fitting with N.S.S. data have used total consumption expenditure as the only explanatory variable. A study was undertaken with two independent variables.

6.4.5 In another study, estimates of Engel elasticities were prepared for 101 items of household consumption covering food, pan, tobacco and intoxicants, fuel and light and clothing.

6.4.6 Preparation of series estimates of capital formation and national income in India, 1857-1900, (approved as plan project for 1979-80 and 1980-81). The project is in progress.

6.4.7 Inter-temporal and inter-regional variation in consumer prices in per capita household consumption in real terms. The study is in progress.

Books published : 1; papers accepted for publication : 3; papers presented at conferences : 3; technical notes prepared : 4.

6.5 *Pre-Census Population Studies*

The main object of the Pre-Census Population Studies Unit is to conduct historical studies based on quantitative data as far as available. The undermentioned research projects were continued during the year.

6.5.1 *Pre-Census Population Studies of India* : The purpose of the project, sponsored by the Registrar-General, India, is primarily to collect materials bearing on population and allied socio-economic variables, prior to the first census of India in 1872. A volume entitled, Report on the Population Estimates of India, Vol. III, 1811-1830, Part A, Eastern Region, is ready to be released from the press.

6.5.2 *Analysis of Socio-economic Trends in Bengali Writings, 1818-1947* : As a part of the compilation of a socio-economic bibliography of India, a volume of materials in Bengali was scrutinised and a survey of the trends of economic writing was conducted.

6.5.3 *Economy of Bengal, 1750-1800* : Some new materials, based on the permanent settlement, was discovered at the West Bengal Archives. A paper was submitted to the India Historical Records Commission on the basis of the data.

6.5.4 *Socio-economic Changes in Rural India* : The purpose of these studies is to bring out trends of socio-economic changes in a historical perspective based on quantitative data. The undermentioned reports are being prepared : (i) Village Ballavpur, District Birbhum, West Bengal, for the period 1825-1975, (ii) 20 villages of Aligarh District, Uttar Pradesh, for the period 1825-1975.

6.5.5 *Statistical Survey of Bengal by Francis Buchanan* : The project was designed to publish the report of statistical surveys conducted by Francis Buchanan. The report on Gorakhpur district is almost ready for the press and the work on Rungpoor district has been started.

Paper published : 1; papers sent for publication : 2; papers read at conferences/published in proceedings : 9.

6.6 *Psychometry*

6.6.1 *The development of an instrument to measure the intelligence of deaf and dumb children for diagnostic purposes* : The analysis was completed of the data collected in connection with deaf and dumb students at Agartala. The test was revised on the basis of the analysis.

6.6.2 *The development of a forced-choice instrument for measuring managerial ability* : The pilot study has been completed for developing a scale for measuring managerial ability and skill. On the basis of this study, it is planned to develop a forced-choice type of scale for measuring different dimensions of managerial skill.

6.6.3 *Usefulness of aptitude, achievement & personality variables in industrial selections* : The report was completed on the experimental study in Bharat Heavy Electricals and on the validity study in Indian Airlines. Validity studies are in progress in Hindustan Aircrafts and Bharat Heavy Plate & Vessels.

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6.6.4 *Biographical factors and their relation to success in academic vocational fields*: Data collected are being analysed for the preparation of a report.

6.6.5 *Study in creative ability*: The aim is to study the relationship between divergent thinking and certain other cognitive variables, like reasoning ability, risk taking, perceptual style and scholastic achievement. Data have been collected from about 400 high school children of both sexes.

6.6.6 *Psychological correlates of serum uric acid and cholesterol*: The aim of this collaborative project with the Biometry Research Unit is to ascertain whether "achievement motivation" is related to levels of uric acid and cholesterol in human blood. Data have been collected for an exploratory study.

6.6.7 *Popular conceptions of mental health*: The purpose is to undertake sample surveys with urban and rural population to ascertain their level of knowledge and attitudes toward mental health problems, and their relation to demographic variables. A suitable methodology is being devised in consultation with experts and in the light of the results obtained from an exploratory study undertaken earlier.

6.6.8 *Internal versus external locus of control*: The internal locus of control or subjective efficacy is "a belief that the environment or the outer world could be transformed through personal effort". A scale to measure this dimension among high school students is being developed.

6.6.9 *Rorschach psychogram through computer programming*: The assessment of personality through Rorschach Psychogram is a very complex phenomenon and also time consuming. In order to simplify and minimise the labour, the present study aims to draw a computer model of scoring and interpretation manual of Rorschach Psychogram. The preliminary work for the study was completed.

6.6.10 *Service*: As in earlier years, the Unit served as a centre for tests of Educational Testing Service, Princeton, U.S.A. and the Psychological Corporation, New York.

Papers published: 2; papers submitted for publication: 3.

6.7 Sociology

6.7.1 *Social science research projects and problems: an inventory/study*: A comprehensive report is under preparation on the basis of information collected from research institutes/university departments in the eastern region of India.

6.7.2 *Changing pattern of marriage institutions in West Bengal—A comparative study (with special reference to legal measures)*: For conducting a pilot study of registry marriage in West Bengal, different source-points were contacted to obtain basic data on registry marriages. Work has already been initiated to collate the recorded basic information of the registered couples from the related government departments.

6.7.3 *Content analysis of views on an aspect of societal change in India: the Hindu-Muslim relations in the eighteenth century, Bengal*: The exploratory field work was conducted in the State Archives, Manuscript Section of Viava-Bharati, Santiniketan, and Record Rooms of District Magistrate, West Bengal. The analysis of collected materials is being carried out.

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6.7.4 *Low society and change—a case study of the Indian situation, 1947-1964. (Nehru era of Indian politics)*: The following two books were published. (i) *Jayaprakash Narayan: Profile of a Non-Conformist* (Kogilah) and, (ii) *Jayaprakash O Sampurna Biplob* (Bangal). The concluding work is in progress on the two volumes, for completing the project.

6.7.5 *A study of the Nepalese system of panchayat democracy.*

One book is in press. The work on the concluding volume of the project is in progress.

6.7.6 *Field research in various (e.g., socio-religious-economic) aspects of societal problems of two States.*

1. Urban growth and rural-urban interaction, socio-economic polarization, social communication and social change and development in certain backward regions of the State, and,

2. Sample survey in Palamu district of Bihar. The analysis of survey materials already collected are in progress.

3. Group relations in Giridih and the surrounding areas.

The processing of data is in progress. Several technical notes were prepared on basis of these materials.

6.7.7 *Study of family structures in India*: Data processing work relating to the project has been started.

6.7.8 *Problems of deforestation in India (under socio-cultural and biological adaptation in contrasting eco-system)*: It is a collaborative scheme for which area selection has been started. One workshop type discussion with other ISI scientists was organised and a draft schedule prepared. The preliminary field work has been started.

6.7.9 *Village re-survey*: Some academic preparations were made and field exploration has been started. A background paper on the study is being prepared.

6.7.10 *Socio-economic structure and change in some selected villages of Birbhum, West Bengal*: This study made an attempt to examine the change in the agrarian social structure. The analysis of the survey materials is almost completed and the report is under preparation.

6.7.11 *Study of Vidhan Sabha elections in a constituency of Midnapore district of West Bengal*: This was a collaborative project between the Jawaharlal Nehru University, New Delhi, and the Indian Statistical Institute. A draft report entitled, "Left Extremism and Electoral Politics: Naxalite participation in Election", has been sent for publication.

6.7.12 *Foreign research students*: The undermentioned research students from the Faculty of Sociology, Bielfeld University, Federal Republic of Germany, did their research work during the year in the Sociological Research Unit: 1. Mr. Wolfgang Hanning, 2. Mr. Heint Bongartz, 3. Miss Urmula Leake. Published papers: 16; papers sent for publication: 8; papers read at conferences: 2; books published: 5; articles published in books: 3; technical notes: 10.

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VII. STATISTICAL QUALITY CONTROL AND OPERATIONS RESEARCH

The work of the Statistical Quality Control and Operational Research Division (S.Q.C. & O.R.) is organised through a comprehensive programme under the broad classification of 1. Consultative Service, 2. Education and Training, 3. Promotional Activities and 4. Applied Research.

7.1 General

7.1.1 The Division undertook new project assignments during the year, apart from rendering consultative service to factories already on its rolls. The Division has so far trained about 26,000 managers, technologists, scientists and operators, produced over 600 specialists and prepared over 475 research and application papers in the field of SQC & OR. In September 1979, the Division started a one-year, full-time programme in SQC & OR for engineers from the Bharat Heavy Electricals Ltd. (BHEL), Madras. This is a parallel course to the one being conducted at the Delhi Centre for the last two years.

7.1.2 The plant services to a variety of industries were aimed at organizing total quality control systems. The main emphasis during the year was on the training at plant level of supervisors, middle level executives, organisation of appreciation programmes for senior executives and also on special project studies to cut down costs by way of reduced waste and rejections in factories and to improve the performance and reliability and quality of the product.

7.1.3 The promotional activities during the year were conducted through participation in and organising of symposia, seminars, conferences, pilot surveys and in-plant demonstration projects, and serving on expert bodies in the field. The Division prepared and published quality control manuals, technical reports and developed audio visual aids for its lecture programmes. To update the knowledge of its specialists and to equip them to handle challenging industrial problems, it also invited practising experts and eminent professors in the field from abroad to organise special course of lectures on selected topics, as well as work-shops.

7.1.4 The Division encouraged its researchers to carry out applied research work to develop new tools and techniques in the field of SQC & OR, to solve industrial problems and also to carry out basic research to advance the frontiers of knowledge.

7.2 Consultative Service :

7.2.1 There were 59 factories taking consultative service as on March 1980. During the period, 13 plants joined the SQC service scheme and 4 factories withdrew their membership. The organisations, covered by the service contract, include heavy electricals and electronics, light engineering, precision tools, drugs and pharmaceuticals, chemicals and textiles. 242 technical reports were sent to the member organisations including a few special study reports on projects of specific interest to the management.

7.2.2 The Division prepared a manual for the BHEL, specifying the procedural aspects covering all stages of erection, and commissioning activity.

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7.3 Education and Training:

7.3.1 During the period, the Division trained 1760 engineers, managers, technologists and others in 63 in-plant course at different centres. Some general and other courses in the basic techniques of SQC, reliability engineering, design and analysis of industrial experiments, and operations research methodology were organised at different centres. Special lectures and one-day seminars were conducted for the executives of BHEL at various centres. The engineers drawn from manufacturing plants of the BHEL completed the one-year training programmes in quality, reliability and operations research in December 1979 at Delhi. For a second batch of 15 engineers, the programme commenced on 1 January 1980. For another batch of 20 engineers from the BHEL, a parallel course was started at Madras in September 1979.

7.3.2 Altogether 123 persons underwent professional training at the post-graduate level in courses at Bombay, Madras and Calcutta and at the under-graduate level in the part-time course at Bangalore. Training was also imparted to 39 students of M.Stat. and B.Stat. (Hons.) in SQC & OR in Calcutta and Delhi.

7.4 Promotional Activities:

7.4.1 Seminars on quality studies were organised at the BHEL units at Hardwar, Bhopal, Ramchandrapuram and Trichy in which all top executives of the plants participated. A two-day seminar on Design of Experiments using Orthogonal Array Techniques was organised at Hyderabad in collaboration with BHEL Corporate QA Division on 9 & 10 January 1980. A number of case applications made in the BHEL Units using the above concepts were presented and discussed at the seminar.

7.4.2 Professor W. T. Federer, University of Cornell, U.S.A., Visiting Professor, also participated in the programme.

7.4.3 Two seminars on vendor development were organised at Jamnagar and Belgaum where a large number of ancillary units supplying material to the BHEL unit participated.

7.4.4 The technical officers of the Division gave 178 lectures and talks to industrial and management personnel, members of professional bodies and other institutions. Promotional visits were paid to 47 plants, 13 pilot studies were completed and 19 reports were sent to factories. The unit staff participated in the training programmes relating to SQC-OR and allied subjects conducted by sister organisations like the Productivity Councils, Institute of Engineers, Railway Training College, Jamalpur, and Small Industries Service Institute.

7.4.5 The SQC Units worked in close cooperation with organisations like the Indian Standards Institution, National and Local Productivity Councils, Small Scale Industries Service Institute, Institute for Packaging, Export Promotion Councils, Operations Research Society, Indian Association of Quality and Reliability, National Institute for Quality Assurance, Universities and other Government and scientific agencies. The programme of collaboration included participation in seminars, training programmes, and technical committees.

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7.5 Applied Research Work :

7.5.1 Theoretical and applied research work is carried on in the following areas : complementarity programming, combinatorial optimization, Bayesian three-decision accept and sample plans, optimal parameters and sampling interval of control charts, computational procedures for tolerance limits for normal population.

7.5.2 A new concept of duality for reliability systems consisting of repair facilities and standby components has now been introduced and the appropriate theory is being developed.

7.5.3 Three large-scale simulation studies are in progress. The objective of the first study is to determine the achievable capacity of a steel foundry subject to several constraints. The second study is aimed at determining the optimum scheduling for heat treatment in the same foundry. The objective of the third study undertaken in Bombay for the Bombay Metropolitan Region Development Authority (BMRD) is to determine the pattern of "staggering of office hours" to ease traffic congestion.

7.5.4 Research papers published : 13; papers submitted for publication/published in conference proceedings : 16; manuals/technical reports prepared : 47.

VIII. LIBRARY, DOCUMENTATION AND INFORMATION SCIENCE

1. Central Library :

1.1 With the addition of 2,832 new books and 682 bound volumes, the total collection of the Central Library at Baranagar rose to 1,81,083 volumes at the close of the year. The library has also a collection of 34,023 reprints, 3,75,000 maps and a large collection of microfilms, microfiches and photoprints. The services of the Branch libraries at Bombay, Bangalore, Giridih and Delhi were co-ordinated with those of the Central Library to serve researchers, students and staff of the Institute.

1.2 *Acquisition* : Two thousand eight hundred and thirty-two books were accessioned during this period, of which 2,063 were purchased, 749 received as gift and 20 received through exchange arrangements.

1.3 *Technical Processing* : The Library classified 2,167 and catalogued 3,399 books. Twenty-one reprints and 71 text books for the Text Books Library were processed. Three issues of the *Quarterly Bulletin* (classified list of current additions to the Library) and 24 issues of weekly bulletin were brought out.

1.4 *Periodicals* : The Library received 2,251 periodicals during the year, of which 673 were received on subscription, 619 on exchange and 959 on a complimentary basis.

1.5 *Membership and Circulation* : The total membership of the library during the period was 3,631 (including staff, research scholars, students and guests), of which the number of student members (outside) were 633 and Institute Members 168. Altogether 882 persons were given special permission to use the reading room facilities, and 47,006 books and periodicals were issued to members during the period. The library borrowed 34 publications from local and out-station libraries and lent 69 publications to other libraries under the inter-library lending arrangements.

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1.6 *Documentation Services* : Six bibliographical projects which were completed, relate to wages, wage structure, and wage differential studies on Calcutta, regression estimation, computer science and related topics. The compilation of "an index of selected articles on energy" and a bibliography on statistics and mathematics were in progress.

A selective bibliography of books and periodical articles on malaria, available in principal libraries in Calcutta, was also compiled on the occasion of the International Symposium : Hundred Years of Malaria Research, Calcutta, 17 January 1980.

1.7 *Reprographic and Photographic Services* : The library provided 89,905 copies of Xerox prints, prepared 5,631 bromide enlargements, 2,860 frames of microfilms of documents, 4,771 photocopies from microfilms, 400 slides, 70 photostat prints from large documents, 227 microfiches and arrange for photographs of 639 scientific and other subject.

1.8 *Translation Service* : Five chapters of the Japanese document "Lectures on Multivariate Analysis" by T. Kitagawa and two German and three Russian documents were translated into English. The checking of transliteration and translation of titles of Russian books was also done. Shri Sunil Bose conducted Russian language classes for B.Stat. students.

1.9 *Reports and Records* : Six hundred and sixteen reports and data books were accessioned. Altogether, 2,039 volumes were processed and shelved according to the new classification scheme and 1,878 official publications were issued.

1.10 *Special Materials Collection* : 530 Russian books were accessioned and 550 Russian books processed. One hundred and seventyfive microfilm copies of rare books, monographs and periodical articles were accessioned and 270 films were classified during the period. A bulletin on the Russian publications available in the Institute Library is under preparation.

1.11 *Circulating Library* : The Workers' Circulating Library had a collection of 29,598 at the end of the year. Six hundred and nine books were added to the stock of the Circulating Library which issued 32,247 books to its readers during the period. Eightyone new members were enrolled.

Project work : The following two projects were completed : (i) Identification of lacunae in periodical holdings of the library, and (ii) Reconciliation of Library stock.

2. *Bangalore Library* :

2.1 Initially, the DRTC Library collection formed the nucleus of the I.S.I. Bangalore Centre Library which came into existence on 14 September 1978.

2.2 The total number of items added to the Bangalore Centre Library during the year 1979-80 was 504; of which 19 were bound volumes of periodicals. Ten current titles of periodicals were subscribed additionally during the year, while 9 earlier titles were discontinued. Fiftyfour books were received on a complimentary basis.

2.3 *Stock position* : The stock position of the ISI Bangalore Centre Library as on 31 March 1980 was as follows. Books : 6575; bound volumes of periodicals : 580; publications received on a complimentary basis : 540.

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2.4 The Library collection consists of publications primarily in the following fields : Library Science; Documentation and Information Science; Mathematics; Statistics; Operation Research; Computer Science; and Economics and Econometrics. The library also contains a small collection of ready reference books, such as encyclopedias, dictionaries, directories and bibliographies.

2.5 All the books procured were classified. Their physical processing is also complete. The cataloguing of these books was taken up.

2.6 *Library Services* : During the period, the ISI Bangalore Centre Library rendered the following services : Circulation; Inter-library loan; Reference; Monthly addition list; Fortnightly list of current issues of periodicals; and Reprography.

3. *Dalhi Centre Library :*

3.1 With the addition of 1,189 new books and 359 bound volumes, the total collection of the Dalhi Centre Library rose to 16,817 volumes at the close of the year. The Library has also a large collection of reprints and technical reports.

3.2 *Acquisition* : One thousand one hundred and eighty nine books were accessioned during the year.

3.3 *Technical Processing* : The Library classified and catalogued 970 books. Nine issues of the monthly list of additions were brought out upto December 1979. The frequency changed to bimonthly from January 1980. One issue of the bimonthly list was published.

3.4 *Periodicals* : The Library received 290 periodicals, of which 280 were received on subscription, one on exchange and 9 on a complimentary basis.

3.5 *Membership and Circulation* : The total library membership was 274 (including staff, research scholars, students and guests), of which outside student members numbered 15 and Institute members were 259. Altogether 135 persons used the reading room with special permission. 7304 books and periodicals were issued and returned to members. The Library borrowed 86 publications from local libraries and lent 30 publications to other libraries under the inter-library lending arrangements.

3.6 *Xeroxing* : Photocopies of about 100 articles consisting of 1,844 pages were provided during the period.

3.7 *Library Trainees* : Two B.Lib.Sc. students from the Department of Library Science, Delhi University, and two students of the diploma course of the Women's Polytechnique joined as trainees.

Mrs. Avinash Khurana, Technical Assistant, was deputed to attend the All India Library Conference, organised by Indian Library Association from 6 to 9 March, 1980.

4. *Documentation Research and Training Centre (DRTC), Bangalore :*

4.1 *Training* : Fourteen candidates were admitted to the course in Documentation and Information Science for 1979-80, which commenced on 1 August 1979. There were three deputed candidates and four candidates joined on study leave.

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4.2 *Research* : Research in documentation and information science was conducted through studies/surveys, the results of which were published. The main areas of research may be grouped as follows :

1. General theory of subject indexing language
2. Postulate-based permuted subject indexing (POPSI)
3. Classaurus
4. Information system designing
5. Methodology for designing codes for cataloguing practice
6. Industrial information systems
7. Information manpower development
8. Studies on the use of Colon Classification in libraries
9. Performance standard
10. Forecasting methods for library management
11. Information needs and services for design engineer
12. Information generation and utilisation in hospitals
13. Study of problems encountered by information centre personnel
14. Budgeting in industrial libraries
15. Classification and indexing in medical sciences
16. Concentration of transactions
17. Computer generation of Thesaurus
18. Computerisation of POPSI
19. Data structure
20. Automated circulation and serial control systems
21. Bibliometrics : distribution of transactions:
22. Bibliometrics : distribution of scientific productivity
23. Guided research activities.

4.3 *Seminars* :

4.3.1 A Refresher Seminar on Standardisation of Bibliographic Description : Principles and Practice, conducted by the DRTC, Bangalore, 20-24 August 1979, was attended by 62 delegates. The seminar was organised as a part of the DRTC programme of providing continuing education to libraries, documentalists and information scientists.

4.3.2 The DRTC Annual Seminar was held in Bangalore, 10-14 December 1979. About 30 papers were presented.

4.3.3 A Seminar on the Evolution of Subject Indexing Language was organised by the DRTC on 15 January 1980. Besides local delegates, students and teachers of the Delhi University attended.

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4.3.4 The first DRTC Research Colloquium, 7 February 1980, had as its theme, "Document and User Distribution in Transaction Records of some Canadian University Libraries".

4.3.5 The Second DRTC Research Colloquium, 7 March 1980, had as its theme, "Contribution of Information to Economic Growth and Development, with special reference to Developing Societies".

4.4 Research Staff on Deputation :

(i) Shri Ravindra Nath Sharma, Reference Librarian and Research Scholar (Ph.D. student), Colgate University, New York, worked in the DRTC on the project, "Impact of Ranganathan on Academic Libraries in India", October-November 1979.

(ii) Shri Dilip Singh and Shri A. R. Sethi, members of the Library staff, Jawaharlal Nehru University, New Delhi, worked in the DRTC on the "Design of subject indexing systems for use in J.N.U. Library".

Papers published : 2; papers sent for publication : 8; papers read at conferences : 17; books published : 1; technical notes : 2.

IX. CONFERENCES, SYMPOSIA AND SEMINARS

Among different conferences, symposia, seminars and workshops organised by the Indian Statistical Institute mention may be made of the following :

9.1 *Workshop on Reprography, Calcutta, 2-5 April 1979* : The workshop sponsored by the Department of Science and Technology, Government of India and INSDOC Regional Centre, Bangalore, was held at the ISI, Baranagar. The course was inaugurated by Dr. A. Maitra, Officiating Director, ISI, and the key-note address was delivered by Shri A. K. Dasgupta, Librarian and Chief Administrator, Administration Staff College, Hyderabad. Altogether 31 participants representing information centres of different scientific institutions attended.

9.2 *A Summer School in the use of Electronic Computers in Research, Bangalore, 1-14 June 1979* : About 40 persons attended the School. Dr. J. Roy was the Course Director and the faculty consisted of local and out-station ISI members and a few others from sister institutions.

9.3 *Workshop in Economic Theory, Calcutta* : To promote research in Economic Theory, the Economic Research Unit, Calcutta, organised two workshops, each attended by about 25 economists from different parts of India. The first workshop, 18-20 August 1979, was on the theory of social production and price theory. The second workshop, 29-31 December 1979, was based on the theme of trade and production in the context of accumulation. Papers were presented by economists from the Jawaharlal Nehru University, New Delhi, Indian Institute of Management, Calcutta, Centre for Studies in Social Sciences, Calcutta, and the University of Calcutta.

9.4 *Meeting of Co-ordination Committee, Leaf Protein Research, 9 & 10 October 1979, Calcutta* : Research on different aspects of leaf protein is conducted in 12-13 centres in

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India and a Co-ordination Committee was formed with their representatives in 1977. The objective of the Committee has been to review, co-ordinate, exchange views and to discuss future programmes of activity.

Besides scientific workers of the Leaf Protein Unit, ISI, ten scientists attended the meeting of the Co-ordination Committee held at the ISI, on 9 & 10 October 1979. They came from different research centres including the Central Food and Technological Research Institute, Mysore, Agricultural Universities in Coimbatore and Hilar, C.S. Azad University, Kanpur, Marathwada University, Aurangabad and other centres in Bangalore, Bombay and Jaipur.

Six reports and ten research papers were presented. The meeting suggested that the ISI team may undertake work on nutritional aspects involving feeding trials in collaboration with the local Agricultural University. The ISI was also requested to work out an integrated approach for maximal utilisation of leaf protein and other products of processing.

9.5 *Symposium on Combinatorics and Graph Theory, Calcutta, 25-29 February 1980*: The symposium, inaugurated by Dr. B. P. Adhikari, Director, Indian Statistical Institute, was attended by 7 participants from abroad and 41 from India. A few others presented papers in absentia. In all, about 65 research papers (including a few review articles) were presented in the areas of combinatorial Mathematics, Graph Theory, and their applications.

Among the foreign participants who attended were Professor C. Berge, France; Professor P. Erdos, and Professor Vera T. Sos, Hungary; Professor D. K. Roy Chaudhuri, USA, and Professor J. J. Seidel, Netherlands. The proceedings of the symposium are being compiled.

X. PUBLICATIONS

The undermentioned publications were brought out during the year.

Sankhyā : The Indian Journal of Statistics, the official organ of the Indian Statistical Institute.

Series A : Vol. 41, Parts 1 & 2 and 3 & 4.

Series B : Vol. 40, Parts 1 & 2 and 3 & 4;

Vol. 41, Parts 1 & 2 and 3 & 4.

Series C : Vol. 41, Part 1.

Series D : Vol. 40, Part 1 (in press).

Technical Reports : Forty-three technical reports from the Statistics-Mathematics group were issued.

XI. SOCIETY-TYPE ACTIVITIES : BRANCHES

1. Karnataka Branch

1.1 *Membership* : There were 82 members at the end of the year (life members : 19; Institutional members : 6; and ordinary members : 37).

Thou new members were enrolled during the year and one member died.

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1.2 *Annual General Meeting*: The twenty-fifth annual meeting of the General Body, Karnataka Branch, was held at Bangalore, 16 August 1979.

1.3 *Office-bearers*: Six office-bearers and six members of the Executive Committee were elected as well as co-opted for the year 1979-80.

1.4 *Seminar*: (i) The Karnataka Branch organised a seminar on "Increasing profit through quality control and other quantitative techniques", jointly with the Institution of Engineers and the Mangalore Management Association, at Mangalore, 19 December 1979. About 25 industrialists participated in the seminar. Shri K. N. Basri, President, Mangalore Management Association, presided.

(ii) A panel meeting on "Management of Urban Water Supply", organised on 6 December 1979, was presided over by Shri Parasiva Murthy, Chairman, Institution of Engineers (India). Among the speakers were Shri K. G. Katwey, Chairman, Bangalore Water Supply and Sewerage Board and Shri S. Subramanian, Special Secretary, Public Works & Electricity Department (Irrigation).

1.5 *Works Advisory Committee*: The Committee which includes local members of the Institute was constituted to look after the construction of the campus buildings at Bangalore.

XII. LIST OF SCIENTIFIC PAPERS AND PUBLICATIONS

12.1 *List of Papers published*

A. THEORETICAL STATISTICS AND MATHEMATICS

1. BHAT, B. R.: "Analyzing qualitative/categorical data" by L. A. Goodman. Book Review. *Current Science*.
2. —: "Applied optimal control", (Ed.) Bensoussan *et al.* Book Review. *Operatrch*.
3. CHANDRA, TAPAS (with Ghosh, J. K.) (1979): Comparison of tests with same Bahadur-efficiency. *Sankhyā*, A, 40: 263-277.
4. — (with Ghosh, J. K.) (1979): Valid asymptotic expansions for the likelihood ratio statistic and other perturbed chi-square variables. *Sankhyā*, A, 41: 1-23.
5. CHATTOPADHYAY, A. K. (with Gupta, A. K.) (1979): Gammaization and Wishartness of dependent quadratic forms. *Communications in Statistics*, A 8 (9): 945-951.
6. JAISWAL, N. K. (with Kumar, Ashok) (1979): Stochastic behaviour of some repairable computer systems. *J. Engg. Production*, 3, 1: 1-13.
7. — (with Kumar, Ashok) (1979): Behaviour of two dissimilar unit imperfect stand-by system with connect switching and priority repair. *ZAMM*, 59, 7: 323-326.
8. MASUMDER, B. S. (1979): Dispersion of solutes in combined free and forced convective flow through a channel. *Acta Mechanica*, Springer-Verlag, 32: 211-216.

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9. MITRA, S. K. (with Khatri, C. G. and Puri, M. L.) (1979) : Matrices G satisfying simultaneous equations $A^*MAG - A^*M$ and $G^*NGA - G^*N$. *J. Ind. Statist. Assoc.*, December (Huzurbasar Volume).
10. NADKARNI, M. G. (1978) : On spectra of non-singular transformations and flows. *Sankhyā*, 41 : 59-66.
11. RAMACHANDRAN, B. (1979) : On the 'strong memorylessness' property of the exponential and geometric probability laws. *Sankhyā*, A, 41, 3 & 4.
12. RAMAMOORTHY, R. V. (with Roy, K. K.) (1979) : Relationship between Bayes, classical and decision theoretic sufficiency. *Sankhyā* A.
13. RAO, B. V. (with Rao, K. P. S. Bhaskara) (1979) : Mixtures of non-atomic measures. III. *Coll. Math.*
14. — (with Rao, K. P. S. Bhaskara and Maitra, A.) (1979) : A problem in the extension of measures. *Illinois J. Math.*, 23 : 211-216.
15. RAO, K. P. S. BHASKARA (with Rao, M. B.) (1979) : Lattice of sub-algebras of a Boolean algebra. *Czechoslovak Math. J.*
16. RAO, S. B. (1979) : Solution of the Hamiltonian problem for self-complementary graphs. *J. Combinatorial Theory*, B, 27 : 13-14.
17. — (1979) : The number of open 3-chains and the parity of the number of open k -chains in self-complementary graphs of given order. *Discrete Math.*, 28 : 291-301.
18. RAMANARAYANAN, R. (with Parthasarathy, P. R.) (1979) : Number of repairs for a two-unit system. *IEEE Transactions on Reliability*, R-28 : 172.
19. — (with Usha, K.) (1979) : n -unit warm standby system with Erlang failure and general repair and its dual. *IEEE Transactions on Reliability*, R-28 : 173.
20. ROY, A. K. (1979) : Convex functions on the dual ball of a complex Lindenstrauss space. *London Math. Soc.*, 20, 3.
21. — (with Ellis, A. J.) (1980) : Dilated sets and characterizations of complexes. *Inventiones Math.*, 66 : 101-108.
22. SINHA, BIMAL KUMAR (1979) : Is the mle of the common mean of several normal populations admissible? *Sankhyā*, B, 40, 3 & 4 : 192-196.
23. SITARAM, A. (1979) : A note on $L^1(\mu SL(2, IR))$. *Michigan Math. J.*, 28 : 325-331.
24. SRIVASTAVA, S. M. (1979) : Selection theorems for $G\delta$ -valued multifunctions. *Trans. Amer. Math. Soc.*, 264, 283-294.
25. — (1980) : A representation theorem for $G\delta$ -valued multifunctions. *Amer. J. Math.*, 102 : 176-178.
26. TRIPATHI, T. P. (with Srivastava, O. P.) (1979) : Estimation on successive occasions using ppswt sampling. *Sankhyā*, C, 41 : 1.

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B. ANTHROPOMETRY AND HUMAN GENETICS

1. BASU, A. (1979) : Identity crisis in anthropology. *Spectra Anthropological Progress*, 2 : 22.
2. — (with Gupta, R. and Bhattacharyya, S. K.) (1979) : Altitude and biology in the Sherpa : an alternative approach to the study of high altitude biology in the context of the eastern Himalayan situation. *J. Indian Anthropological Society*, 14 : 140-148.
3. — (with Roy, M. and Majumder, P. P.) (1978) : A study on the relationship between digital dermatoglyphic traits : interfinger, (Pi, TRC) and (Pi, ATRC) correlations in a Santal population sample. *Indian J. Physical Anthropology & Human Genetics*, 4 : 123-131.
4. BHARATI, P. (with Ghosh, A. K., Dey, B., Das, S. K., Roy, M., Banerjee, S. K. and Gupta, R.) (1979) : A comparative study of red cell enzymes in Mirpur (a Portuguese descendant community) and a neighbouring Hindu community in Gopalchak. *Human Heredity*, 30 : 142-144.
5. MALHOTRA, K. C. (1979) : Inbreeding among Dhanger castes of Maharashtra, India. *J. Biosocial Science*, 11 : 397-409.
6. — (1980) : Roma of the USSR and the Indian Bhangra dance : some observations. *Roma*, 5 : 34-38.
7. — (1978) : Inbreeding and marriage distance among three tribes of Maharashtra. *J. Indian Anthropological Society*, 13 : 89-94.
8. — (1979) : Inbreeding among the four Dhanger castes of Maharashtra, India : differences among districts. *Colloquium Anthropologicum* 2 : 35-46.
9. — (with Gadgil, M. G.) (1979) : Role of deities in symbolizing conflict of dispersing human groups. *Indian Anthropologist* 9 : 83-92.
10. — (with Mukherjee, B. N. and Kate, S. N.) (1979) : Incidence of red-green colour blindness in some populations of Delhi, Maharashtra and West Bengal : an examination of the selection relaxation hypothesis. *J. Biosocial Sciences*, 11 : 11-16.
11. — (with Majumder, P. P.) (1979) : Matrimonial distance, inbreeding coefficient and population size : Dhanger data. *Ann. Human Biology*, 6 : 17-27.
12. — (with others) (1978) : Genetic distance analysis among nine endogamous population groups of Maharashtra, India. *J. Human Evolution*, 8 : 567-570.
13. — (with others) (1979) : Genetic polymorphism analysis among 9 endogamous population groups of Maharashtra, India. *J. Human Evolution*, 8 : 555-566.
14. — (with Kanhere, G. M. and Bhanu, B. V.) (1978) : Relationship between total ridge count, absolute ridge count and pattern intensity index in digital dermatoglyphics. *Indian J. Physical Anthropology & Human Genetics*, 5 : 49-55.
15. — (with Chakraborty, P.) (1978) : Social structure of a pilgrim town-Tarakewar (West Bengal) : an exploratory study. *J. Social Research*, 22 : 96-127.

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16. MALHOTRA, K. C. (1978) : Dental caries among the population of Georgia from earliest times to the present day by M. Z. Inasavili (Book Review). *J. Indian Anthropological Society*, 14 : 92-93.
17. MUKHERJEE, B. N. (with Malhotra, K. C. and Kate, S. L.) (1978) : Incidence of red-green colour blindness in some populations of Delhi, Maharashtra and West Bengal: an examination of selection relaxation hypothesis. *J. Bio-social Science, London*, 11 : 11-16.
18. — (with others) (1978) : Genetic polymorphism among nine endogamous groups of Maharashtra, India. *J. Human Evolution, Italy*, 8 : 555-566.
19. — (with others) (1978) : Genetic distance analysis among nine endogamous groups of Maharashtra, India. *J. Human Evolution, Italy*, 8 : 567-570.
20. PAKRASI, KANTI (with Malakar, O. R.) (1978) : Marriage and population policy. *J. Indian Anthropological Society*, 14, 2 : 95-106.
21. — (1978) : On some aspects of population problem. *Man and Life*, 5, 3 & 4.

C. APPLIED STATISTICS, SURVEYS AND COMPUTING

1. ARNAB, RAJESWATH (1978) : On the relative efficiencies of some sampling strategies under a super population model. *Jour. Ind. Soc. Agri. Statist.*, 31 : 89-96.
2. BANDHYOPADHYAY, SUBHAS (1978) : Two population classification in Gaussian process. *J. Statistical Planning and Inference*, 3.
3. CHAUDHURI, A. (with Mukhopadhyay, Parimal) (1978) : A note on how to choose the sample size for Horvitz-Thompson estimation. *Cal. Stat. Assoc. Bull.* : 149-154.
4. — (1978) : On estimating the variance of a finite population. *Metrika*.
5. — (1978) : On the choice of sample size for the Horvitz-Thompson method of estimation. *J. Indian Agricultural Statistics*.
6. — (with Arnab, R.) (1978) : On the role of sample size in determining efficiency of Horvitz-Thompson estimators. *Sankhya C*.
7. GHOSH, SUBIR (1978) : On robustness of designs against incomplete data. *Sankhya, B*, 3 & 4 : 204-208.
8. MUKHOPADHYAY, PARIMAL (1978) : Estimating the variance of a finite population under certain super population set up. *Metrika* : 115-122.
9. SENGUPTA, A. (with Bandyopadhyay, S. and Srimani, P. K.) (1978) : On identification of CB property in file organisation. *Information Processing Letters*, August.

D. BIOCHEMISTRY

1. BASU, A. (with Gupta, R. and Bhattacharyya, S. K.) (1978) : Attitude and biology in the shorpa: an alternative approach to the study of high-altitude biology in the context of the eastern Himalayan situation. *J. Indian Anthropological Society*, 14 : 140-148.

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E. CROP SCIENCE

1. DAVIS, T. A. (1979): Asymmetry in *Coccoloba speciosa* (Boitardaceae). *Phytomorphology*, 28(4): 373-378.
2. — (with Altovogt, R.) (1979): Golden means of the human body. *Fibonacci Quart.*, 17(4): 340-344, 384.
3. — (with Bhattacharyya, C.) (1979): Bilateral symmetry in the reproductive structure of some palms. *J. Bombay Nat. Hist. Soc.*, 76: 698-717.
4. —: Urbanisation in nest building of Indian crows (*Corvus splendens* Vieillot). *J. Bombay Nat. Hist. Soc.*, 76: 283-290.
5. GHOSE, M. (1980): Ontogenetic study of stomata and trichomes in some palms. *Phytomorphology*, 29(1): 26-33.
6. GHOSE, S. S. (1979): Coconut: an ideal crop for Orissa coast. *Indian Coconut, J.*, 10(4): 1-2.

F. DEMOGRAPHY

1. CHAKRAVORTY, B. (1979): Problems and prospects of population education in India's rural setting. *Indian J. Social Research*, XX, 2.
2. — (1978): An analysis of the spatial distribution of the district level fertility data in India: preliminary observations. *Demography India*, 7, 1 & 2: 233-242.
3. RAMAN, M. V. (1979): Marriage age: the preferred and prescribed. *The Hindu*, Madras, June, 26.
4. — (1979): Opinion of Calcutta couples on ideal age of marriage for boys and girls. *J. Institute Economic Research*, Dharwar, XIV, 2, July: 17-27.
5. SARKAR, B. N. (1978): Development, migration and work participation. *Demography India*, 7, 1 & 2: 211-232.

G. DIGITAL ELECTRONICS

1. DATTA GUPTA, J. (with Srinani, P. K.) (1979): Single fault equivalence classes and minimal tests sets in combinational networks. *International J. Electronics*, 47, 3: 297-310.
2. PAL, A. (1979): A programmable PRBS generator. *Electronics*, September.
3. SINHA, B. P. (with Srinani, P. K. and Choudhury, A. K.) (1979): A new method to find out the chromatic partition of a symmetric graph. *International J. Systems Science*, 10, 1.
4. SRINANI, P. K. (with Sengupta, A. and Bandopadhyaya, S.) (1979): On identification of OR property in file organization. *Information Processing Letter*, 9, 2: 93-96.
5. SRINANI, P. K. (with Mitra, A. D.) (1979): Research notes: differential pulse-code modulation. *International J. Electronics*, 46, 6: 633-637.

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6. SRINIVAS, P. K. : Enumeration of all minimal feedback edge sets in a directed graph. *International J. System Science*, 10, 13.
7. — (1979) : Generation of direct circuits in a directed graph. *I.E.E.E. Proceeding Letters*, August.

H. DOCUMENTATION AND LIBRARY SCIENCE

1. RAVICHANDRA RAO, I. K. (1980) : The distribution of scientific productivity and social change. *J. American Society for Information Science*, 31 : 111-122.
2. SEETHARAMA, S. (1979) : Angiology: depth classification version of CO. *Library Science with a Slant to Documentation*, 16 : 35-61.

I. ELECTRONICS AND COMMUNICATION SCIENCE

1. CHAUDHURI, B. B. (with Pal, D. K.) (1979) : Propagation through hollow cylindrical anisotropic dielectric guide. *IEEE Trans. Microwave Theory and Tech.*, 27, 2 : 170-172.
2. — (1979) : Sensitivity analysis of optical waveguides. *IEEE J. Quantum Electronics*, 15, 7 : 545-546.
3. — (1980) : Wave propagation through weakly anisotropic straight and curved rectangular dielectric guide. *IEEE Trans. Microwave Theory and Tech.*, March.
4. — (1980) : Guided waves in anisotropics slabs. *J. Inst. Elec. & Telecom. Engrs.*, May.
5. DAS, J. (with Chowdhury, F. B.) (1979) : Charge pumping linear delta modulation. *Electronics Engineering*, April, 51 : 620.
6. — (1979) : Dual monk synchronization technique for PCM/TDM communication system. *Indian J. Pure and Applied Physics*, 17, 9.
7. DATTA, A. K. (with Ganguli, N. R. and Ray, S.) (1980) : Recognition of unspirated plosives; a statistical approach. *IEEE Trans. Acoustic, Speech and Signal Processing*, ASSP-28, 1 : 85-91.
8. — (with Ganguli, N. R.) (1980) : Automatic speech recognition in intelligence communication. *J. Inst. Electronics & Telecommunication Engineers*, 26, 1 : 82-84.
9. DUTTA MAJUMDAR, D. (with Parui, S. K. and Choudhuri, B. B.) (1980) : Some algorithms on preprocessing of two-tone pictures for image analysis. *J. Inst. Elec. & Telecom. Engrs.*, 26, 1 : 21-28.
10. — (with Datta, A. K. and Ganguli, N. R.) (1980) : Acoustic features of consonants: a study based on Telugu speech sounds. *Acustica*, 44, 5.
11. — (with Das, J. and Chatterjee, N.) (1979) : Some studies on minimization of intersymbol interference by coding techniques. *Indian J. Pure and Applied Physics*, May 17 : 323-328.

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12. DUTTA, MAJUMDER (with Das, J. and Chatterjee, N.) (1979): On the effect of phase error in digital communication systems. *International J. Electronics*, June 46: 596.
13. — (with Datta, A. K. and Pal, S. K.): Self-supervised vowel recognition system *Pattern Recognition*.

J. ENTOMOLOGY

1. BRAHMACHARY, R. L. (1980): Germination of seeds in dung balls of African elephant. *Revue Ecol. (Terre Vie)*, Paris, 34: 139.
2. — (with Ray, B.) (1979): Inhibition of cerulenin of RNA and lipid synthesis in *Limnaea*. *Exptl. Cell Biol.*, 47: 202.
3. — (with Dutta, J.) (1979): Phenylethylamine as a biochemical marker in the tiger. *Zf. Naturforsch.*, 34C: 632.
4. — Phomomone of tigers: experiments and theory. *American Naturalist*.

K. ENTOMOLOGY

1. DASGUPTA, P. C. (1980): On the biology of the malaria vector in Calcutta (abstract). *Proc. International Symposium on Hundred Years of Malaria Research, Calcutta, 77*.

L. GEOLOGY

1. CHATTERJEE, S. (with Sohn, I. G.) (1979): Freshwater ostracodes from Late Triassic coprolites of India. *J. Paleontology*, 53(3): 578-586.
2. JAIN, S. L. (1980): Freshwater Xenacanthid (= Pluracanth) shark fossils from Upper Triassic Maleri formation, India. *J. Geological Society of India*, 21(1): 39-47.
3. — (with Kuttly, T. S., Roychowdhury, T. and Chatterjee, S.) (1979): Some characteristics of *Barapasaurus tagerei*, a sauropod dinosaur from Lower Jurassic of Deccan, India. *Proc. IV International Gondwana Symposium. 1977, Calcutta: 204-216*.

M. LEAF PROTEIN

1. CHAKRABORTY, S. (with Chandra, A. L. and Malai, S.) (1979): Isolation of lipase producing soil streptomycete. *Sci. and Engg.*, 32(5): 143-144.
2. — (with Malai, S. and Chandra, A. L.) (1979): Extracellular lipase production by a soil streptomycete. *Curr. Sci.*, 48(8): 268-269.
3. — (with Malai, S. and Chandra, A. L.) (1979): Isolation of soil actinomycetes with proteo-lytic activities. *(Microbiol. Bull. AMI, India)*, Calcutta Unit, 1(3): 15.
4. CHANDA, SUNANDA, (with Chakrabarti, S. and Malai, S.) (1979): A study on microbial load of the whey, a waste from leaf protein production plant. *Microbiol. Bull. AMI (India)*, Calcutta Unit, 3(2): 15-17.

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N. PHYSICS

1. GUPTA, A. B. (1979) : Tensile-mechanical properties of hair. *Ind. J. Dermatology*, 24, 4 : 49-51.
2. — (with Ghosh, K. G. and Haldar, B.) (1979) : Studies on the tensile properties of human scalp hair. *Ind. J. Dermatology*, 23, 4.
3. — (with Ghosh, K. G. and Haldar, B.) (1980) : Studies on the tensile properties of human gall bladder. *Science & Engineering*, 33, 1 : 7-11.
4. — (with Ghosh, K. G. and Haldar, B.) (1979) : Comparison of the tensile properties of human scalp hair with and without natural pigments. *Ind. J. Dermatology*, 24, 4 : 52-55.

O. PHYSICS OF FLUIDS

1. BHATTACHARYYA, P. (with Ghosh, A.) (1979) : Laminar boundary layer on the conical surface of a hydrocyclone and its behaviour on entering the solid body rotating liquid. *Cal. Math. Soc. Bull.*, 71, 4 : 221-234, August.
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P. PLANNING, ECONOMIC STATISTICS AND ECONOMETRICS

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12.3 Papers submitted/accepted for publication :

(The journal to which the paper is submitted for publication is mentioned within brackets).

A. THEORETICAL STATISTICS AND MATHEMATICS

1. BAGCHI, BHASKAR : On a class of Dirichlet series with large zero-free region. (*Trans. Amer. Math. Soc.*).
2. BEAT, B. R. (with Prasad, M. S.) : W-efficiency of maximum likelihood estimators for non-ergodic stochastic processes.
3. — (with Adke, S. R.) : Maximum likelihood estimation for branching processes with immigration.
4. CHANDRA, T. (with Ghosh, J. K.) : Valid asymptotic expansions for the likelihood ratio and other statistics under contiguous alternatives. (*Sankhyā*).
5. — (with Ghosh, J. K.) : Deficiency for multiparameter testing problems. (*Sixtieth Birthday Volume of C. R. Rao*).
6. CHATTOPADHYAY, A. K. : Selecting the normal population with the largest (smallest) value of Mahalanobis distance from the origin. (*Communications in Statistics*).
7. DAS, AJIT KUMAR : On the use of auxiliary information in estimating proportions. (*J. Indian Stat. Assoc.*).
8. DAS, PRABHU (with Rao, S. B.) : Alternating Eulerian trials with prescribed degree in two-edge coloured complete graphs. (*Discrete Mathematics*).
9. — (with Gangopadhyay, T.) : Some results on graceful and allied numberings. (*Utilitas Mathematica*).
10. GHOSH, J. K. (with Sinha, B. K. and Subramanyam, K.) : Edgeworth expansion for Fisher-consistent estimators and second order efficiency. (*C.S.A. Bull.*).
11. — Comments on a paper by Cox and Barndorff-Nielsen. (*J.R.S.S., Series B*).
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14. — (with Basu, A. P.) : Identifiability of distributions under competing risks and complementary risks model. (*Communications in Statistics*).
15. — (with Basu, A. P.) : Asymptotic properties of a solution to the likelihood equation for the independent not identically distributed case with life testing applications. (*J.A.S.A.*).
16. — (with Morimoto, H. and Yamada, S.) : Neyman factorization and minimality of pairwise sufficient subfields. (*Ann. Stat.*).
17. — (with Mukhopadhyay, N.) : Sequential procedures in identification. (*Communications in Statistics*).
18. JAISWAL, N. K. (with Ramamurty, K. G.) : Some results of pseudo semi-Markov processes.

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19. — (with Ramamurthy, K. G.): Duality in a two unit cold stand-by system.
20. — (with Krishna, J. V.): Analysis of two dissimilar redundant system with administrative delay in repair. (*Int. J. Systems Science*).
21. JEGANATHAN, P.: On a decomposition of the limit distribution of a sequence of estimators. (*Sankhyā*).
22. — An extension of a result of L. Le Cam concerning asymptotic normality. (*Sankhyā*).
23. — On the convergence of moments of statistical estimators. (*Sankhyā*).
24. — On the asymptotic theory of statistical estimation for dependent observations. (*Sankhyā*).
25. — Some asymptotic properties of risk functions in estimation when the limit of the experiment is mixed normal. (*Sankhyā*).
26. MAITRA, A.: An effective selection theorem. (*J. Symbolic Logic*).
27. MATHEW, JOSEPH (with Nadkarni, M. G.): Some results on cocycles and spectra on Ergodic flows. (*Sixtieth Birthday Volume of C. R. Rao*).
28. — (with Nadkarni, M. G.): Some remarks on a papers of Helson and Parry. (*Arkiv for Matematik*).
29. MAJUMDER, D. (with Bhimasankaram, P.): Hermitian and non-negative definite solutions of some matrix equations connected with the distribution of quadratic forms. (*Sankhyā*).
30. NADKARNI, M. G.: Some measure theoretic remarks on inner foundations and related results. (*Sankhyā*).
31. NAIK, D. N.: Some estimating the parameters of a 2-out-of-3: F system. (*IEEE Transactions on Reliability*).
32. PARTHASARATHY, K. R. (with Sinha, K. B.): A random Trotter-Kato product formula. (*Sixtieth Birthday Volume of C. R. Rao*).
33. RAMAKRISHNAN, S.: Finitely additive Markov chains. (*Trans. Amer. Math. Soc.*).
34. — Stationary initial distributions for finitely additive Markov chains. (*Trans. Amer. Math. Soc.*).
35. RAMAMURTHY, K.: Convergence of age and type distributions in multitype critical Bellman-Harris processes. (*J. Applied Probability*).
36. RAMANARAYANAM, R. (with Usha, K.): General analysis of systems in which 2-unit system is a sub-system. (*Zeitschrift Mathematische Operations forschung and Statistik*).
37. RAO, K. P. S. BHASKARA: On generalised inverses of matrices over principal ideal rings. (*Linear & Multilinear Algebra*).

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39. Rao, S. B. (with Naik, B. N., Shrikhande, S. S., and Singhi, N. M.): Intermotion graphs of k -uniform linear hypergraphs. (*European J. Combinatorica*).
40. — (with Taneja, A.): Characterization of unipseudograph and unmultigraphic integer-pair sequences. (*Discrete Maths.*).
41. — (with Das, Prabir): Alternating Eulerian trails with prescribed degrees in two-edge coloured complete graphs. (*Discrete Maths.*).
42. — A survey of combinatorial theory and optimal design. (*Ann. Discrete Maths.*).
43. — Characterization of forcibly planar degree sequences. (*Ars Combinatoria*).
44. Rao, T. J.: Horvitz-Thompson strategy vs. stratified random sampling strategy. (*Scandinavian J. Statistics*).
45. — Unbiasedness and convexity in ratio estimation. (*J. Statistical Planning & Inference*).
46. — (with Ramachandran, Geetha): Choice of estimators under certain linear regression models. (*Australian J. Statistics*).
47. Roy, A. K.: Orderings and delations of complex representing measures. (*Quarterly J. Maths.*, Oxford).
48. Roy, A. K. (with Ellis, A. J. and Rao, T. S. S. R. K.): Some characterizations of complex Lindenstrauss spaces. (*Trans. Amer. Math. Soc.*).
49. SARDAR, K.: On quasitransitive semi-group actions. (*Semi-group Forum*).
50. — Optimum experimental designs. (*Seminar Notes*, Monograph, Statistical Publishing Society).
51. — (with Mukhopadhyay, B. B.): On a characterization of regression models under intraclass covariance structure for the robustness of the usual likelihood ratio test. (*Calcutta Statistical Association Bull.*).
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58. SRIVAM, ALLADI (with Bagchi, S. C.): Spherical mean periodic functions on semi-simple Lie groups. (*Pacific J. Maths.*).
59. — An analogue of the Wiener-Tauberian theorem for spherical transforms on semi-simple Lie groups. (*Pacific J. Maths.*).
60. SAIVATSA, V. V.: Existence of measurable selectors and parametrizations for G -valued multifunctions. (*Fundamenta Mathematicae*).
61. TRIPATHI, T. P.: A general class of estimators for population ratio. (*Sankhyā*).
62. — A general class of estimators for population ratio. (*Sankhyā* C).
63. — (with Maiti, Pulakesh): Use of prior information on some parameters in estimating population mean. (*Sankhyā* B).
64. — (with Maiti, Pulakesh): Estimation of population total using information on some units of population. (*Biometrika*).
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66. — (with Das, Ajit Kumar): A class of sampling strategies for population mean using knowledge on the variance of an auxiliary character. (*Australian J. Statist.*).
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68. — Estimation of a population parameter using information on several statistics. (*J. Stat. Planning & Inference*), USA.

B. ANTHROPOMETRY AND HUMAN GENETICS

1. BASU, A. (with Biswas, S. K.): Is Indian Anthropology dying? (*J. Indian Anthropological Society*).
2. — (with Gupta, R. and Bhattacharyya, K. K.): A demographic study of Mirpur: a village in coastal Midnapore district, West Bengal. (*J. Biosocial Science*).
3. GUPTA, R.: Selection intensity in the Sherpas. (*Current Anthropology*).
4. MALHOTRA, K. C. (with Gadgil, M. G.): Ecology of a pastoral caste: The Gavli Dhangars of Peninsular India. (*Current Anthropology*).
5. — (with Karmakar, B.): Finger dermatoglyphics in schizophrenia. (*J. Indian Anthropological Association*).
6. — (with Bhanu, B. V.): Sinitan cross polymorphism in 3 Mendelian isolates. (*J. Dibrugarh University*).
7. — Matrimonial distances among the four Dhangar castes of Maharashtra, India: differences among districts. (*South Asian Anthropologist*).

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8. MALHOTRA, K. C. (with Sarkar, A.): Genetics of cartilagenous lump at the back of human ear. (*J. Human Heredity*).
9. — (with others): Inbreeding, village endogamy and marriage distance: spatial, temporal and social variation. (*HOMO*).
10. — (with Kanhere, G. M.): Distribution of some cephalofacial characters. (*J. Physical Anthropology & Human Genetics*).
11. —: Somatoscopic variation among 5 population groups of Delhi. (*J. Comparative Physiology and Ecology*).
12. — (with Chakravarti, R. and Bhanu, B. V.): Variations on dermal ridges in nine population groups of Maharashtra India. I. Intra and inter population diversity. (*Human Heredity*).
13. MOKHERJEE, B. N.: Enzyme polymorphism: variation in Indian population. (*Acta Anthropogenetica*).
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C. APPLIED STATISTICS, SURVEYS AND COMPUTING

1. ARNAS, RAJHUNATH: Two-stage sampling over two occasions. (*Aust. Jour. Statist.*).
2. BANDYOPADHYAY, S. (with De, N., Srimani, P. K. and Sengupta, A.): Checking $p-t$ diagnosability of a system. (*Computers & Electrical Engineering*).
3. BANDYOPADHYAY, SHYBHAS: Improved ratio and product estimators. (*Sankhyā C*).
4. — Monotonicity of the probability of correct classification in autoregressive process. (*Sankhyā B*).
5. CHAKRABORTY, S. R.: On some tests in MANOCOVA model with unequal covariance matrices. (*Communications in Statistics*).
6. — (with Giri, N. C.): Locally minimax test of equality of two covariance matrices. (*Archiv Der Mathematik*).
7. — (et. al.): Tests for the mean vector under intraclass structure. (*J. American Statistical Association*).
8. — Tests for intra-class covariance structure against circular symmetry. (*Canadian J. Statistics*).
9. — (with Giri, N. C.): On asymptotically minimax test of MANOVA. (*Sankhyā*).
10. GHOSH, S.: Robustness of three dimensional designs.
11. — On behaviour of Srivastava-Chopra optimum designs in presence of outliers.
12. — (with Roy, J.): Optimality in presence of outliers.

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13. CHOUHURY, A. (with Arnab, R.): On estimating the mean of a finite population sampled on two occasions with varying probabilities. (*Australian J. Statistics*).
14. —: A comparison of relative efficiencies of sampling strategies under a model. (*J. Indian Society Agricultural Statistics*).
15. — (with Arnab, R.): On non-negative variance estimation. (*Métrica*).
16. — (with Arnab, R.): On the relative efficiencies of sampling strategies under a super-population model. (*Sankhyā C*).
17. DE, N. (with Sengupta, A., Bandyopadhyay, S. and Srimani, P. K.): A new method to test system diognostability. (*Information Processing Letters*).
18. — (with Bandyopadhyay, S., Sengupta A. and Srimani, P. K.): On certain investigations on self diagnosable systems. (*International J. Systems Science*).
19. GROSS, S.: On single and multistage factor screening procedures. (*J. Combinatorics, Information and System Sciences*).
20. — On main effect plus one plans for 2^m factorials. (*Ann. Statistics*).
21. MUKHOPADHYAY, A. C.: On the property P_1 and balanced asymmetrical factorial plans. (*Acta Combinatoria*).
22. MUKHOPADHYAY, PARIMAL: Optimum strategies for estimating the variance of a finite population under a super-population set up. (*Métrica*).
23. — Optimal estimation of finite population variance under generalised random permutation models. (*Canadian J. Statistics*).
24. — On estimation of some confidential characters from survey data. (*Cal. Stat. Assoc. Bull.*).
25. — Optimal estimation of a finite population mean under exchangeable general linear models. (*Aust. J. Statistics*).
26. — (with Haldar, A.): Bayesian tables for Warner's randomised response probabilities. (*Demography*).
27. SENGUPTA, A. (with Palit, A., Chattopadhyay, D. K. and Chowdhury, A. K.): Realization of fault-tolerant machines—linear code application. (*IEEE Trans. Computers*).
28. — (with Srimani, P. L.): Algebraic determination of circuits in a directed graph. (*International J. Systems Science*).

D. BIOCHEMISTRY

1. BHATTACHARYA, S. K. (1980): Intestinal parasitic infestation in two populations inhabiting contrasting habitats. (*Indian J. Public Health*).
2. MUKHERJEE, JAGATYOTI (with Pal, P. R.) (1980): Distribution of alkaline inorganic pyrophosphate in the green leaves of plants. (*Z. Pflanzenphysiologie*).

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E. CHEMISTRY

1. GHOSAL, D. N. (with Das, T.): Amino acid distribution in the humic and fulvic fractions of the organic matters in some selected West Bengal soils. (*J. Indian Society Soil Science*).
2. — A comparative study of the physico-chemical properties of the organic matters of some Turai and old alluvial soils of West Bengal. (*Indian Agriculturist*).

F. DEMOGRAPHY

1. CHAKRAVORTY, B.: Problems of obtaining data on health of the population. (*J. Medical Profession*).
2. RAMAN, M. V.: The Census enumerations. (*J. Institute Economic Research*), Dharwar.

G. DIGITAL ELECTRONICS

1. DATTA GUPTA, J.: A graphical approach to the determination of test sequences for sequential circuits. (*Digital Processing*), U.K.
2. PAL, A.: 710 controls the charging current of a battery charger. (*Electronica*), U.S.A.
3. SETHI, B. P. (with Choudhury, A. K. and Srimani, P. K.): A new approach to program verification. (*J.A.C.M.*).
4. — (with Choudhury, A. K. and Srimani, P. K.): An address generation scheme which minimizes the control memory requirements in microprogrammed digital computers. (*International J. Electronics*).
5. SRIMANI, P. K. (with De, N., Bandyopadhyay, S. and Sengupta, A.): Some studies of $p-t$ diagnosable system. (*I.E.E. Proceedings, Computer and Digital Technique*).
6. — Generalized proof of modified Booth's algorithm. (*Computer & Electrical Engineering*).
7. — (with Sengupta, A.): Algebraic analysis of multiple faults in combinational networks. (*International J. System Science*).
8. — Generation of directed circuits in a directed graph. (*Proceedings Letters, I.E.E.E.*).
9. — (with Sengupta, A.): Algebraic determination of circuits in a directed graph. (*J. System Science*).
10. — (with Bandyopadhyay, S., De, N. and Sengupta, A.): Checking $p-t$ diagnosability of system. (*Computer & Electrical Engineering*), U.S.A.
11. — (with Bandyopadhyay, S. and De, N.): On certain investigation on self diagnosable systems. (*International J. Systems Science*).

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H. DOCUMENTATION AND LIBRARY SCIENCE

1. BHATTACHARYYA, G.: Some significant results of current classification research in India. (*International Forum on Information and Documentation*).
2. ——— Library profession in India and Ranganathan. (*Golden Jubilee Souvenir, Madras Library Association*).
3. DEVADASON, F. J. (with Balasubramanian, V.): Computer generation of thesauri from structured subject propositions. (*Information Processing & Management*).
4. ——— Standardisation of computer readable bibliographic record: a proposal for a common exchange/communication format. (*Library Science with a Slant to Documentation*).
5. GOPINATH, M. A.: Astronomy: Depth classification version of CC. (*Library Science with a Slant to Documentation*).
6. RABICHANDRA RAO, I. K.: Entropy of a probability distribution of transaction/uses: A measure of concentration of transactions/uses over documents. (*Library Science with a Slant to Documentation*).

I. ELECTRONICS AND COMMUNICATION SCIENCE

1. CHAUDHURI, B. B.: A periodic structure for mode filters at optical and microwave frequencies. (*Applied Optics*).
2. DAS, J. (with Chowdhury, F. B.): A microprocessor based PSU modulator. (*Electronic International*).
3. DATTA, A. K. (with Ganguli, N. R.): Terminal frequencies of CV combination in multisyllabic words. (*Acustica*).
4. DUTTA MAJUMDER, D. (with Chaudhuri, B. B.): Possibility theory in man-machine system reliability analysis. (*IEEE Trans. Reliability*).
5. ——— (with Das, J. and Chatterjee, N.): On minimization of intersymbol interference in magnetic record reproduction system. (*International J. Electronics*).
6. ——— (with Das, J. and Chatterjee, N.): On adaptive quantization of speech-like signals. (*JIBTE*).

J. EMBRYOLOGY

1. TAPASWI, P. K. (with Bhattacharyya, P.): An extended mathematical model of transcription and translation during embryogenesis. (*Cybernetica*, Belgium).
2. ——— Time lags in an extended model of transcription and translation during embryogenesis. (*Cybernetica*, Belgium).
3. BRAHMACHARY, R. L. (with Guha, T.): Ultrastructure of early embryonic cells of *Limnaea*. (*Zf. Naturforsch.*, West Germany).

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K. GEOLOGY

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2. — (with Hutton, N.): The paleogeography of India: a critical assessment. (*Smithsonian Contributions to Paleontology*).
3. KUTTY, T. S. (with Bose, M. N. and Mahowari, H. K.): Plant fossils from the Gangapur formation. (*Palaeobotanist*).
4. SENGUPTA, SUPRIYA (with Adhikari, A. K. and Roy, J.): Estimates of parameters of grain-size distribution from Weight frequencies. (*J. International Association Math. Geology*).

L. LEAF PROTEIN

1. BAUCHI, D. K. (with Maiti, S.): Performance of turnip as root and protein yielding crop in West Bengal. (*Ind. Jour. Agron.*).
2. — (with Chanda, S.): Note on the effect of age on root and extracted protein yield in two varieties of beetroots. (*Ind. Jour. Agri. Sci.*).
3. CHANDA, S. (with Chakrabarti, S. and Bagchi, D.K.): Propagation of yeast in whey, a by-product from leaf protein production plant. (*Current Science*).
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6. — (with Mitra, P.): Flow of a dusty gas between two parallel plates, one being at rest and other oscillating. (*Def. Sci. Jour.*)
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8. CHANDER, PARLASH : Non-linear input-output models. (*Econometrica*).
9. CHATTERJEE, G. S. : On errors in National Sample Survey household budget data. (*Economic & Political Weekly*).
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12. DUTTA, B. : Strategic voting in a probabilistic framework. (*Econometrica*).
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20. — On methods of demand projections. (*Sankhya D*).
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27. SARA, SOMESH CHANDRA: Some further estimates of Engel elasticities for rural and urban India. (*Sankhya D*).

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2. DEB ROY, RAMA: Indian economy as viewed by Akabya Chandra Sarkar. (*Bull. Socio-Economic Research Institute*).

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2. — A comparative study of the inmates of detention home and almshouse children with respect to neuroticism, environmental and certain biographical factors. (*Japanese J. Psychology*).

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2. CHAKRABARTI, P.: Puri pilgrim study. (*The Eastern Anthropologist*), Lucknow.
3. CHATTOPADHYAY, K.: Policies and research: need for coordination. (*The Eastern Anthropologist*), Lucknow.
4. CHATTOPADHYAY, M.: Changes in levels of living: a case study in rural society of Birbhum. (*Economic & Political Weekly*), Bombay.
5. GHOSH, T. N.: On the impact of the Social Marriage Act (1954): an experience from Calcutta. (*The Eastern Anthropologist*), Lucknow.

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3. BANDYOPADHYAY, SHIBDAS (with Roy, J.): Enumeration errors: a case study. Symposium on Advances in Methods of Data Collection, Validation, Storage, Retrieval and Analysis, ISI, Calcutta, 17-20 January 1980.
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2. — Vascotomy and tubectomy operations in India. Proc. Fifth Annual Conference, Indian Association for the Study of Population, Bombay, 28-30 January, 1979.
3. — Households in villages of West Bengal. Proc. Fifth Annual Conference, Indian Association for the Study of Population, Bombay, 28-30 December 1979.
4. — Non-enrolment of children in schools and reporting error in data collection. Proc. Symposium on Advances in Methods of Data Collection, Validation, Storage Retrieval and Analysis, Calcutta, 17-20 January, 1980.
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1. DATTAGUPTA, J. (with Dattagupta, R. and Choudhury, A. K.): Partition of faults into equivalence classes and their application to location of faults to a replaceable module. Symposium on Mini-Micro Computers and Automation, Roorkee, March 1979, 3.78-3.88.
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4. SUREA, B. P. (with Gahsthakurta, A. and De, N.): Connection routing algorithm on printed circuit boards. Symposium on Mini-Micro Computers and Automation, Roorkee, March 1979, 5.16-5.26.
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3. — On industrial information systems. DRTC Annual Seminar, 17; 1979, Paper OB.
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13. — Industrial library budget: preparation and justification. DRTO Annual Seminar; 17; 1979.
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2. BETTY, C. A. : Process optimisation and cost reduction through orthogonal array techniques. Western Regional Conference & Seminar on Management Responsibility in Developing Broad Policies as regards quality, Baroda, 10 July 1979.
3. — (with Anand, K. N.) : Involving operators in the company QC improvement programme. Conference, International Assoc. for Quality Circles, San Francisco, February 1980.
4. RAO, R. ANANTHA (with Chowdhuri, A. K.) : Improving quality/hold through process specification development. Conference, International Assoc. for Quality Circles, San Francisco, February 1980.

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2. ROY, BINA : *Capital Formation in India*. Das Gupta and Company Pvt. Ltd., June 1978.
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2. ——— Jaysprakash Narayan: Profile of a Non-Conformist. Minerva Associates, Calcutta.
3. ——— Palace People and Politics: Nepal in Perspective. Ankur Publishing House, New Delhi.
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4. NATARAJAN, S. : An exposition of Ornstein's Isomorphism Theorem. Mimeo Notes : pp. 134; ISI-MacMillan Lecture Notes Series.
5. RAMANARAYANAN, R. (with Usha, K.) : Availability of a parallel system.
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2. GOPINATH, M. A.: Jawaharlal Nehru University Library: observational studies and suggestions, April 1979.
3. INFORMATION SYSTEM DESIGN (Course material prepared for the UNESCO Training Course in Information Handling, New Delhi, 10-22 September, 1979; and for the International Course on Information Storage and Retrieval Systems, conducted by SIET Institute, Hyderabad, October-December 1979).
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L. SOCIOLOGY

1. BISWAS, S. K. et al. : Is anthropology dead/dying !
2. — Anthropology in India.
3. CHAKRABARTI, P. : Pilgrimage and bio-social factor.
4. CHATTOPADHYAY, K. (with De, Dhruvajyoti) : Urbanization and urban India : a review with the example from Giridih.
5. — History of social development and societal distributions in Giridih : a study from the perspective of urbanization.
6. — The method of social area analysis and its application on Giridih : a study of a sample sub-area from the perspective of urbanization.
7. — Ward as a unit of sub-area analysis in the study of urban sociology.
8. — (with Sen, Sandip) : Selection of destitutes for developmental purpose : some critical observations on scheduled caste policy.
9. — A study on the socio-economic changes brought in by fish-farms in Nezat area of Sundarban region.
10. CHATTERJEE, SALLI KR. : Field survey in Palamanu district (in Bengali).

M. STATISTICAL QUALITY CONTROL

1. Training Course manual on 'Industrial experimentation and SQC' for short-term training course.

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3. Case study on 'Cost reductions through OR application' by V. Narayana Iyer.
3. Manual for the training course organised for non-gazetted officers, Ordnance Factories (Eastern Region).
4. Manual for training course (in Bengali) for operators, Ordnance Factories (Eastern Region).
5. Some fraction defective attribute sampling plans for multiple quality characteristics—Parts I & II by A. Majumdar.
6. 'An optimal strategy of process control and final inspection' by K. K. Banerjee and K. N. Chatterjee.
7. 'Estimation of parameters in a defect interference inspection scheme' by K. K. Banerjee and S. P. Mukherjee.
8. 'A new strategy for inventory control' by K. K. Banerjee.
9. 'An optimisation problem of paper industry' by K. K. Banerjee.
10. 'An optimisation problem of Jute industry' by K. K. Banerjee.
11. 'Coal programming approach to quality control problem' by S. Sengupta.
12. 'An optimal steel plant—waster linkage—a case study on application of L.P' by K. K. Banerjee.
13. 'An optimum inspection system for a paper plant—case study by K. K. Banerjee.
14. 'Optimal product—mix for an engineering industry—case study on application of L.P' by K. K. Banerjee.
15. Training manual on SQO for course organised at Jamnagar for the ancillary industry of BHEL.
16. Training manuals on SQO (in Marathi) for Inspector and Operator training programmes at Messrs. Kirloskar Pneumatic Co. Ltd.
17. Training manual on SQO for intensive course at Messrs. Bajaj Tempo Ltd.
18. Training manual for Executive Course on SQO & Reliability.
19. Training manual for course on SQO & Industrial Experimentation.
20. Training manual for course in SQO (in Marathi).
21. Training manual on SQO (in Marathi) for Inspectors & Production Supervisors training programmes at Messrs. Kirloskar Pneumatic Co. Ltd.
22. 'Flowship scheduling problem' (Doctoral thesis, March 1980) by N. R. Achuthan.
23. 'Reduction of coating weight on X-ray films' by J. Venkatesappaiah.
24. 'Study on improvement of sugar recovery' by C. Y. Krishnamurthy and C. R. Prasad.
25. 'Wastage, reduction in cutting of transformer core sheets' by C. Y. Krishnamurthy.

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26. Notes on 'Moulder & Quality' Course at BHEL.
27. Notes on 'Maintenance & Quality' Programme at BHEL.
28. Notes on 'Ancillaries & Quality' Programme at BHEL.
29. Notes on 'Quality Control for Purchase Personnel' Programme at BHEL.
30. Notes on QC Course at Shriram Refrigeration Industries.
31. Manual on training course on 'Field Quality Assurance' at BHEL.
32. Training manual on 'An introduction to probability theory and application' for one-year special training course for BHEL engineers, Madras.
33. Training manual on 'Descriptive Statistics' for one-year special training course for BHEL engineers, Madras.
34. Training manual on 'Control chart theory and application' for one-year special training course for BHEL engineers, Madras.
35. Training manual on 'Acceptance sampling' for one-year special training course for BHEL engineers, Madras.
36. Training manual on 'Linear Programming' for one-year special training course for BHEL engineers, Madras.
37. Training manual on 'Design and analysis of industrial experiments' for one-year special course for BHEL engineers, Madras.
38. Training manual on 'Reliability theory & life testing' for one-year special training course for BHEL engineers, Madras.
39. Training manual on 'Queuing theory and maintenance management' for one-year special training course for BHEL engineers, Madras.
40. Training manual on 'Tests of hypothesis and analysis of variance' for one-year special training course for BHEL engineers, Madras.
41. Training manual on 'QA experimentation' for IAQR tutorials at Bangalore & Baroda and for courses at different BHEL plants.
42. Training manual for QC courses for foundry personnel.
43. Course manual on 'Quality orientation programme' at Messrs. Kiloekar Bros. Ltd., Dewas.
44. Course manual on 'Reliability Engineering' for Control Equipment Division, BHEL.
45. Course manual on 'Quality Development Programme' at Elmeca Works, Dharwar.

**Part II : Convocation, Visiting Scientists, Honours and Awards,
Scientific Tours and Assignments.**

XIII. FOURTEENTH CONVOCATION : INDIAN STATISTICAL INSTITUTE

13.1 The Fourteenth Convocation of the Indian Statistical Institute, held on 25 April 1980, was presided over by Shri Subimal Dutt, President of the Institute. Dr. S. Varadarajan, Chairman and Managing Director, Indian Petrochemicals Corporation Ltd. and President, Indian Academy of Sciences, delivered the Convocation Address on "The Use of Hydrocarbon Sources", Dr. B. P. Adhikari, Director, I.S.I., presented the annual review of research and training.

Seven candidates were awarded the Ph.D. degree, 27 the M.Stat. degree by examination, and 16 the B.Stat. (Hons.) degree. Nine candidates were awarded the Statistician's Diploma after successfully completing the Professional Examinations in Statistics. In the post-graduate diploma in applied statistics, 50 candidates were awarded diplomas in Statistical Quality Control and Operations Research, after successfully completing their training in Bombay, Calcutta, Delhi and Madras. Three candidates were awarded diplomas in Computer Science and 2 candidates received the Associateship in Documentation, after training at Bangalore.

13.2 Annual Review by B. P. Adhikari, Director :

Mr. President, Mr. Chairman, Dr. Varadarajan, Mrs. Mahalanobis, distinguished guests, candidates receiving degrees and diplomas, students and colleagues of the scientific disciplines and the administration, I have great pleasure in presenting to you a brief review of the activities of the Institute since the last convocation in the following pages. A more detailed account is available in the Annual Report. I shall not narrate those details, but shall only attempt to point out certain important features and acquaint you with some of our more pressing needs and important problems.

This Annual Report shows that the activities of research, teaching and the promotion of statistical techniques have been pursued as vigorously as in past years. This was the second year of the Bachelor of Statistics course under the new system, and the system is being kept under review. The corresponding curriculum of the Master of Statistics course is being worked out and will shortly take a final shape. Certain reforms have also been made in the teaching programme of the International Statistical Education Centre in consultation with the Education Committee of the International Statistical Institute. The second one year specialised course on operations research, quality and reliability for engineers of the Bharat Heavy Electricals Limited was completed in Delhi and the third course commenced in Madras. We have been informed by the BHEL that these courses have been of benefit to the organisation in building up teams of competent quality engineers. The scientists of the SQC and OR Division of the Institute have, on their part, profited by way of the acquisition of intimate knowledge of the quality problems of the heavy electricals industry. The large number of excellent project reports prepared as part of the in-plant work of this course testify to this widening and intensification of expertise. You were informed at the last Annual Review that the one-year diploma course in computer science

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had been extended to a two-year programme. This programme has now been reexamined by a group of some of the best specialists in the country on the subject. During this examination and the examination of other post-Master's diploma courses, the Academic Council has found it desirable to introduce a degree between the M.Stat. and the Ph.D. A final decision has yet to be taken. Among special courses conducted this year, mention may be made of the Summer School held in June 1979 at Bangalore on the use of electronic computers in research and development.

As will be seen from the Annual Report, the research activities of our scientists have been as varied and of as good a quality as in past years. Besides pursuing their individual and collective researches, our scientists have participated in a large number of scientific seminars and conferences and have organised a few in the Institute. Under joint sponsorship with the Department of Science and Technology and the Indian National Scientific Documentation Centre, a workshop on reprography was held in the Institute at Calcutta in April 1979. In December 1979, a conference on functional analysis and its applications in physics was organised at the Delhi Centre. Also in December 1979, there was a workshop at Calcutta to promote research in certain directions of economic theory. A Symposium on Combinatorics and Graph Theory was held in Calcutta in February 1980, where, apart from many of the active and well-known mathematicians in these fields in India, there was fruitful and active participation of such eminent mathematicians as Professors Paul Erdős and Vera Soos from Hungary, Claude Berge from France, J. J. Seidel from the Netherlands and D. K. Raychaudhuri from the U.S.A.

I would like to dwell on some special aspects of our research activities. Since statistics as a body of techniques deals with efficient and scientific methods of data collection through surveys and experimentation and with the analysis of data for scientific inference in the face of uncertainty, it has potential relevance to all areas of research which are based on observation and experimentation or which derive theories based on probabilistic assumptions. It is also historically true that many of the important techniques of statistics and much research on probability have evolved from the requirements of such sciences and technologies as agriculture, genetics, psychology, economics, physics, industrial production and telecommunications. In view of its essential relevance to sciences, R. A. Fisher had employed the term 'key technology' for statistics. This theme was further developed by P. C. Mahalanobis. Carrying forward the idea of this interrelationship into the activity pattern of an Institute of Statistics, Professor Mahalanobis had pleaded that, both for the development of new methods of statistics and the mutual benefit of statistics and natural and social sciences, it would be advisable to have researches in some areas of these sciences in the Institute. This position had been formally accepted by Government as early as in 1962. The stated objectives of the Institute, formulated after much discussion among a large body of scientists of the Institute and incorporated in the Memorandum of Association after approval of the Government, also reflect the same understanding. It is our expectation, therefore, that the Government will continue to provide sustenance to the Institute to continue its efforts for the fulfilment of these objectives. It is also to be expected of the scientists of the Institute to fulfil those objectives. It can be asserted with confidence that by and large the research output of the Institute, in statistics and mathematics as well as in the different natural and social sciences in which research is undertaken, compares well

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in quality and quantity with the performance of other institutions of research in these subjects. How far the objective of the mutual development of statistics and the other sciences is being achieved is a matter of a more thorough examination. A few current examples of the benefit of coexistence are the researches in quantum mechanics and quantum probabilities, attempts at understanding the processes of molecular biology through probabilistic methods and the explanation of empirical and experimental data on sediment transport and deposit in river flows by using deterministic and probabilistic models. Example of the potential use of statistics, and which might receive immediate attention, are the statistical measurement of linguistic distance to differentiate between dialects and languages, probabilistic and statistical methods in signal detection and pattern recognition, and the measurement of anthropological differences between endogamous groups based in a complex set of metric and nonmetric characters. In each of these areas competent groups have been conducting research for some years and a closer collaboration with probabilists and statisticians is likely to produce results which will bear the distinctive mark of the Institute.

As has been customary over many years in the past, our scientists have, besides pursuing their activities of teaching and research, participated in many expert committees of the Central and State Governments, advised in planning and executed research and survey projects for those Governments.

The research and teaching activities of the Institute are well appreciated not only in the relevant professional groups in the country but also in other countries of all continents. Visits of short and long duration by scientists from different countries for seminars, lectures and participation in research have been a constant feature of the Institute, and this has continued to be so during the year under review, as will be seen from the list of visiting scientists in the subsequent pages.

It is a sign of maturity for any scientific organisation to introspect from time to time and to review its own achievements and deficiencies and thus to find guidance for future work. On the basis of a decision of the Council taken about a year ago, the process of such a review has been initiated and will be conducted with the help of scientists outside the Institute, who are well known in their respective fields, and directions for the work of the Institute for the years of the near future determined.

I must mention at the end that we pursue our activities in the Institute, particularly at the headquarters at Calcutta, with physical facilities which are much below the standards obtaining in almost any campus of higher learning in India, even those which do not match the stature of this Institute. There is no comparable institution where students have lived for twenty years in sheds with tin roofs, where the administrative services are housed either in ramshackle barracks or in old buildings which are in danger of giving way. The Institute has no auditorium, but only a makeshift affair to seat about two hundred persons. Even as far back as in 1967 the first Review Committee had found the then Research and Training School in an unsuitable building which, with the further passage of thirteen years, is in a state which may be dangerous for the occupants. Activities which constituted the Research and Training School continue in this same building. There are only a few faculty flats and no new construction for faculty residence has taken place since 1967. The low-salaried employees, many of whom are in the essential services, have never had any properly habitable quarters. There are a number of hastily-built tenements along the walls inside

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the campus, constructed many years ago probably as offshoots of building activities undertaken then, and employees live in these with their families, crowded in unsatisfactory rooms, because they cannot afford the rents outside. The first Review Committee had recommended, and the Government had accepted, that the Institute should have a staff housing programme. We have made plans and, knowing the financial constraints of Government, we have made them modest. We are even prepared to ask for loans from the Housing Development Corporation, but this is conditional on an initial outlay. Our expectation with Government is that we shall be permitted to relieve the distress of our employees in the matter of residential accommodation to some extent. It is heartening that we now have new premises for our library, computer and reprographic equipment. We also have a new hostel for the B.Stat. and M.Stat. students. If, in the next five years, apart from the realisation of staff housing schemes at Calcutta, Delhi and Bangalore, we can build the proposed second hostel for senior students and the remaining five floors of the new building which has a foundation suitable for ten storeys, if we can also construct a proper auditorium, medical welfare centre and a workers' canteen, our very essential needs may be satisfied. These items of construction, together with the development of the Bangalore Centre where construction will begin soon, appear to make up a long list but would not, in fact, amount to such a formidable sum of expenditure spread over five years. Let us be warned that working and living conditions are in a bad state and, if these are allowed to continue, unpleasant things may happen, which will bring credit neither to the Institute nor to the Government which has declared it as an institution of national importance.

In conclusion, may I gratefully express my thanks to Shri Subimal Dutt, President of the Institute and Shri P. N. Haksar, Chairman of the Institute, for their kind readiness to provide wisdom and counsel. I thank all our colleagues at different levels of scientific and administrative functions for their cooperation. I must also thank the ISI Workers' Organisation for its concern over the development and smooth functioning of the Institute and the rationality of its approach even in complex issues, which facilitates the working of the Institute.

13.3 Convocation : International Statistical Education Centre, Calcutta

The International Statistical Education Centre (ISEC), Calcutta, held its annual convocation on 26 March 1980. Certificates were awarded to 26 trainees from 14 countries who successfully completed the thirty-third term of the I.S.E.C. (June 1979-March 1980). Shri Subimal Dutt, President of ISI, presided and Shri Satyabrata Sen, Planning Adviser, Government of West Bengal, delivered the Convocation Address. Dr. B. P. Adhikari, Director, ISI, welcomed the guests. Dr. N. Bhattacharyya, Member-Secretary, I.S.E.C., presented the report of the term.

XIV. VISITING SCIENTISTS

A number of distinguished scientists from 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 at the Institute to assist in the regular research and teaching programme and some came for short periods on different assignments for giving lectures and participating in conferences and seminars.

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PROFESSOR YADOLLAH DODGE, School of Planning and Computer Applications, Tehran (5 October 1979-8 November 1979) came to the Delhi Centre for work in connexion with co-authorship of a book on "OR Applications in Statistics" with Dr. T. S. Arthanan, SQC Division. He had come to the Institute earlier in mid-1976.

PROFESSOR JACQUES H. DAREX, Catholic University, Louvain, Belgium, stayed for one month at the Delhi Centre (February 1980). *Lectures*: (i) Temporary equilibrium, price rigidities and macro-economic foundations of macro-economics (12 lectures), (ii) Some topics on Bayesian economics (*Delhi & Bangalore*).

PROFESSOR W. T. FREDER, Department of Biological Statistics, Cornell University, USA (16 December 1979-14 January 1980) gave a short course on the Design of Experiments for the SQC staff, Delhi Centre. He participated in a seminar on Design of Experiments using Orthogonal Array Techniques organised by the Corporate Quality Assurance Division, B.H.E.L., Hyderabad. He also visited Bangalore and Madras. *Lectures*: (i) Generalized block design, (ii) Covariance analysis of designed experiments versus statistical packages, (iii) Cochran-like and Welch-like solutions for linear contrasts of more than two means and with unequal variances.

PROFESSOR DUORDJE KOSTIC, Director of Research and Scientific Adviser, Institute for Experimental Phonetics and Speech Pathology, Belgrade (2 January 1980-10 April 1980) came on his twelfth consecutive visit in connexion with the programme of fundamental linguistic research being conducted in collaboration between the Institute for Experimental Phonetics and Speech Pathology and the Indian Statistical Institute.

During the years of his association with the Indian Statistical Institute, Professor Kostic has studied the phonetic structure of major Indian languages in collaboration with Indian linguists and has written six books, four on phonetics and two on speech habilitation of the hearing impaired, all of which have been printed and published. He has also written several technical papers and tests for evaluation of speech sounds articulation.

During the year, Professor Kostic was in Calcutta, Delhi and Hyderabad in connexion with his research work.

In Hyderabad, he conducted a workshop (21 January 1980-5 February 1980) on the following topics:—(i) Selective auditory filter amplification: its utilization in diagnosis and treatment of hearing-impaired children, (ii) Ductile boxes: their utilisation in treatment of totally deaf or profoundly deaf children, (iii) Classification of hearing-impaired children in five groups and treatment of each group, and (iv) Articulatory evaluation of Telugu speech sounds. He had discussions in the Department of Linguistics, Umania University, on the general programme of collaborative research in linguistics and a One-year Diploma Course in Speech Pathology to be introduced in the University.

In Calcutta, Professor Kostic delivered the key-address on "Basic Principles of Speech Habilitation of Hearing-impaired Children" at the invitational Seminar on "The Integrated Approach to Speech Pathology" organised at the Indian Statistical Institute, on 16 March 1980. He had discussions with Dr. B. P. Adhikari, Director, ISI, and other scientists on the present and future of linguistic research and possibilities of expansion.

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In Delhi, he addressed the participants at the Seminar on Stylistics at the Delhi University, 28 March 1980. He had discussions at the National Council of Educational Research and Training on the possibility of organising a Centre for Speech Habilitation of Hearing-Impaired Children and on the preparation of a methodology for speech habilitation of hearing-impaired children with Hindi as their mother tongue. He had discussions at the Department of Linguistics, Delhi University, on a One-year Diploma Course in Speech Pathology and on the programme of collaborative research in linguistics.

Dr. S. MITRA, Emory University, Atlanta, Georgia, U.S.A., worked in the Demography Research Unit as Visiting Professor for four months (September-December 1979). Seminar: Modification of life table functions as death is escaped K times.

PROFESSOR YOSHIKAZU TSUDA, Quality Control Expert, Rikkyo University, Japan (10-25 June 1979) had discussions with the staff of the SQC Units in Bangalore, Calcutta and Delhi. He conducted a number of colloquia and visited some industries in these regions. Lecture: Industrial development through quality control and national standards.

II. The following are some of the scientists who paid short visits, gave lectures and/or seminars and participated in conferences.

Dr. B. D. ACHARYA, Mehta Research Institute, Allahabad (25-29 February 1980). Lectures: (i) Extension of a bound for the domination number of a graph due to abbot and Liu, (ii) New direction in the mathematical theory of balance in cognitive organisation.

Dr. VIJAY G. ASHER, I.B.M., Hopewell Jn., New York, U.S.A. (4 March 1980). Lecture: Multicollinearity and mean squared error estimation: a comparative estimation. (Stat-Math., Bangalore).

Ms. K. BALLASUBRAMANIAN, Indian Institute of Technology, Madras (25-29 February 1980). Lecture: Muir algebra, permanents and Latin squares.

PROFESSOR B. BALDESSARI, University of Rome, Italy (16 December 1978-31 January 1979). Lecture: Some aspects of analysis of dependent data.

Dr. A. K. BASU, Department of Mathematics, Laurentian University, Sudbury, Canada (2 July 1979-27 March 1980). Lecture: (i) Berry Esseen type results for martingales, (ii) Rates of convergence for central limit theorems, (iii) Limit theorems in probability. (Calcutta and Bangalore).

Dr. D. BASU, Department of Statistical Consulting Centre, Florida State University, Tallahassee, Florida, U.S.A. (28 November 1979-6 December 1979). Lecture: (i) What is information? (ii) Bayesian approach in solving bioassay problems.

SURI S. K. BHATTACHARYYA, Indian Institute of Science, Bangalore (April-July 1979). Course of 16 lectures: Quantification in information Science, (DRTC, Bangalore Centre).

PROFESSOR C. BESOU, Centre de Mathématique Sociale, Paris (25-29 February 1980). Lecture: Dipositive graphs (Special invited address in the Symposium on Combinatorics and Graph Theory).

PROFESSOR R. BRANSDEN, Department of Theoretical Physics, University of Durham, USA (30 January 1980). Lecture: New ideas on controlled nuclear fusion.

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PROFESSOR W. G. BRIDGES, University of Wyoming Laramie, Wyoming, USA (7-19 October 1979). *Lectures*: (i) The determination of 2-class cycle schemes, (ii) Some path length problems for graph and diagraphs.

PROFESSOR JACQUES CHANCHAL, Ecole des Hautes Etudes de Amerique Latine, Paris (19 September 1979). *Lecture*: Land reforms in Latin America.

PROFESSOR S. D. CHATTERJEE, Ecole Polytech Federale, France (2 December 1979). *Lecture*: A subsequence principle in probability theory. (*Stat.-Math.*, Bangalore).

DR. P. K. CHATTOPADHYAY, Reader in Forensic Science, Punjab University, Patiala (7 June-5 July 1979) worked on his project "Blood groups from human hard tissues" in the Anthropometric and Human Genetics Unit. *Seminar*: Hair as an aid to personal identification.

DR. Y. P. CHAUBE, Department of Mathematics, Concordia University, Montreal, Canada (13 December 1979). *Lecture*: Estimation of variance components.

DR. (MRS.) P. D. CHAWATEE, Bombay University (25-29 February 1980). *Lecture*: 2-3 perfect graphic degree sequences.

DR. S. A. CHOUDHURI, Madurai University, Madurai (25-29 February 1980). *Lecture*: Characterization of forcibly outerplanar graphic sequences.

DR. E. J. CLEGG, M.D., M.R.C.P., Department of Anatomy, Marischal College, University of Aberdeen, U.K. has carried out extensive empirical studies on environmental biology and is at present co-ordinator of Man and Biosphere 6 project (24-27 February 1980). He had extensive discussions in the Anthropometry and Human Genetics Unit. *Seminar*: Environmental aspects of child growth.

DR. S. G. DAMI, School of Mathematics, Tata Institute of Fundamental Research, Bombay (2 October 1979-30 November 1979). *Lecture*: On random walk on groups: Poisson spaces of Harmonic functions.

DR. M. N. DAS, Chairman, Water Commission, New Delhi (5 February 1980). *Lecture*: Some results in Galois field theory.

SENI PRERMADEB DAS, Kalyani University, West Bengal (25-29 February 1980). *Lecture*: Construction and combinatorial properties of orthogonal arrays with variable number of symbols in rows.

PROFESSOR T. A. DAVIS, UND/FAO Coconut Agronomist, Indonesia (6 July 1979). *Seminar*: Wild life of Indonesia.

DR. SOMESH DASGUPTA, University of Minnesota, USA (25 June 1979). *Lecture*: Brunn-Minkowski inequality and its aftermath.

DR. G. M. DEB, Department of Mathematics, University of Ottawa, Canada. (19 June 1979-21 July 1979). *Lecture*: How big are the increments of a Weiner process?

DR. OTTO EBERS, Head, Department of Anthropology, Eotvos Lorand University, Budapest, Hungary (4 March 1980). *Lecture*: Researches in physical anthropology human biology in Hungary.

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PROFESSOR T. ESWANT, University of California, USA (7-10 January 1980). *Lecture* : Representations of the groups.

PROFESSOR P. BRDOS, Mathematical Institute, Academy of Sciences, Hungary (25-29 February 1980). *Lectures* : (i) Problems and results on finite and infinite combinatorial analysis and graph theory (Special invited address in the Symposium on Combinatorics and Graph Theory). (ii) Problems and results in number theory.

MR. M. K. GUZL, Mehta Research Institute, Allahabad (25-29 February 1980). *Lectures* : (i) A note concerning Acharya's conjecture on a spectral measure of structural balance in a social system. (ii) A graph theoretical recurrence formula for computing the characteristic polynomial of a matrix.

DR. J. M. GANI, Chief, Division of Mathematics and Statistics, CSIRO, Canberra, Australia; Chairman, Statistical Education Committee, International Statistical Institute (14-16 November 1979) visited the Institute to discuss measures to improve the training activities of the International Statistical Education Centre. *Lecture* : Stochastic models in biology.

PROFESSOR Y. HAMDOUNE, Centre National de la Recherche Scientifique, Paris (24 February 1980-1 March 1980). *Lecture* : A survey on the theory of connectivity of a directed graph (Special invited address in the Symposium on Combinatorics and Graph Theory).

PROFESSOR SHERI HART, Stanford University, USA (October 1979). *Lectures* : (i) An optimisation problem arising in economics. (ii) A theory of endogenous coalition formation. (iii) Repeated games and repeated economics. (iv) Value of non-atomic games (*Delhi & Bangalore*).

PROFESSOR JEAN HIERNAUX, Equipe d'Ecologie Humaine de l'Université, Paris VII and CNRS Fellow, is carrying out bioanthropological studies in sub-Saharan Africa, including biological distances' (28-29 February 1980). He had discussions in the Anthropometry and Human Genetics Unit. *Seminar* : My experiences in multivariate distance.

PROFESSOR S. IKEDA, Science University, Tokyo, Japan (23-25 February 1980). *Lecture* : Finsler geometry and its applications.

DR. S. S. IYER, Scientist-in-charge, National Information Centre for Drugs and Pharmaceuticals, Lucknow (7 February 1980). *Lectures* : Role of NICDAP in coordination of health science, and library activities in India. (*DRTC, Bangalore Centre*).

PROFESSOR R. E. KALMAN, Department of Mathematics, University of Florida, USA. (31 October 1978-1 November 1979). *Lecture* : A theorem on power series.

DR. C. G. KHATRI, University of Gujrat, Ahmedabad, (18-20 February 1980). *Lecture* : A characterization of multivariate damage distribution.

DR. E. V. KRISHNAMURTY, Indian Institute of Science, Bangalore (25-29 February 1980). *Lecture* : Computers topology and drug design. (Special invited address in the Symposium on Combinatorics and Graph Theory).

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MR. V. KRISHNAMURTHY, Indian Institute of Technology, Madras (25-29 February 1980). *Lecture*: A class of counter examples to a conjecture on diameter critical graphs.

SHRI A. KRISHNAN, Scientist-in-charge, Indian National Scientific Documentation Centre, New Delhi (18 March 1980). *Lecture*: Activities of INSDOC (DRTC, Bangalore Centre).

DR. D. KOLZOW, Faculty of Mathematics, Friedrich-Alexander-Universität Erlangen Nuremberg, Federal Republic of Germany (1 September 1979-24 October 1979), accompanied by Mrs. Kolzow, visited Bangalore, Calcutta and Madras. *Lectures*: (i) Lifting and differentiation of measures; (ii) Abstract Wiener spaces; (iii) Survey of reproducing Kernel Hilbert Spaces and Abstract Wiener Spaces.

PROFESSOR J. GIL DE LAMADRID, University of Minnesota, USA, accompanied by Mrs. de Lamsdrid visited Madras and Bangalore (1 March 1979-19 April 1979). *Lectures*: (i) Some topics in Abelian harmonic analysis, (ii) The abstract moments problem.

PROFESSOR ANDRÉ BLAN LAPIERRE, Ecole Supérieure d'Électricité, Centre National de la Recherche Scientifique, Laboratoire des Signaux & Systèmes, Gif-sur-Yvette, France (6 February 1980). *Lecture*: Doubly orthogonal expansions for random functions with positive mean power.

PROFESSOR RENU LASKAR, Clemson University, USA (24 February 1980-1 March 1980). *Lectures*: (i) On some finite geometries, (ii) On domination on related concepts.

SHRI L. S. MALAYATHI, Indian Institute of Science, Bangalore (25-29 February 1980). *Lecture*: A heuristic method for the Hamiltonian path completion problem.

DR. A. K. MALLIK, Department of Mathematics and Statistics, University of Pittsburgh, USA (16 May 1979-10 March 1980). *Lecture*: Optimal stopping and free boundary problems with application to sequential analysis.

DR. V. V. MENON, Banaras Hindu University, Varanasi (25-29 February 1980). *Lecture*: The local central limit theorem for stirling numbers of the second kind, and an estimate for ball numbers.

PROFESSOR SAMARENDRA MITRA, Department of Sociology, Emory University, Atlanta, Georgia, USA (1 September 1979-15 December 1979). *Lectures*: (i) Fertility rates based on both sexes, (ii) Modification of life table functions as death in escaped K. Tines.

DR. S. MOHAN, Indian Institute of Sciences, Bangalore (5 April 1979). *Seminar*: Nuclear power and developing countries.

PROFESSOR S. D. MORANTI, Michigan State University, U.S.A., Visiting Professor, Stat. Math. Unit, Bangalore Centre (Arrived 2 November 1979).

SRI S. S. MONDAL, Chief Conservator of Forests, Government of West Bengal (11 March 1980). *Seminar*: Management of forests in West Bengal.

DR. ADAM MOSTON, Deputy Head, Department of Methodology, Central Statistical Office, Hungary (29 January 1980-4 February 1980). *Lecture*: Prices in Hungary with special reference to foreign trade.

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DR. MONT NAO, Senior Associate, Centre for Policy Studies, Population Council, New York (14 February 1979). *Lecture* : How modernization can also increase fertility.

PROFESSOR K. NAMBA, Tokyo University, Japan (16 January 1980-15 February 1980). *Lecture* : Boolean valued analysis.

PROFESSOR MARION F. NEWTS, University of Delaware, U.S.A. *Lecture* : Algorithmic methods of probability. (*Stat.-Math., Delhi Centre*).

SHERI R. PANDA, Kalyani University, West Bengal (25-29 February 1980). *Lecture* : Construction of group divisible rotatable designs.

DR. K. R. PARTHASARATHY, Indian Institute of Technology, Madras (25-29 February 1980). *Lecture* : In search of a complete invariant for graphs (Special invited address in the Symposium on Combinatorics and Graph Theory).

DR. USMILA PRINOLE, National Institute of Nutrition, Hyderabad (21 January 1980). *Lecture* : Diet and nutritional status of two tribal groups of Central India.

DR. E. PLATEN, Central Institute of Mathematics and Mechanics, Berlin, Academy of Sciences, German Democratic Republic, visited Calcutta and Bangalore (8-21 February 1980). *Lectures* : Approximation of stochastic differential equations.

SHERI C. R. PRANESAGHAR, Indian Institute of Science, Bangalore (25-29 February 1980) *Lecture* : Enumeration of Latin rectangles via SDRs.

PROFESSOR BALDEV RAI, University of Western Ontario, Canada (18-28 June 1979). *Lectures* : (i) Bell system scale economics estimated from a randomly varying parameter model; (ii) Inter-regional comparison of production technology under technological uncertainty; (iii) Dynamics of Canadian deposit-taking institutions : a Markovian approach; (iv) A polynomial distributed log model with stochastic co-efficients and priors; (v) Security prices and default of a firm under anticipated inflation; (vi) Variable co-efficients approach to wage-price behaviour in the United Kingdom (*Economic Analysis Unit, Bangalore Centre*).

PROFESSOR A. K. RAJAGOPAL, Department of Physics and Astronomy, Louisiana State University, USA (9 August 1979). *Lecture* : Some studies in pseudo one dimensional magnetic systems.

MR. S. RAMACHANDRAN, Kamraj University, Madurai (25-29 February 1980). *Lectures* : (i) Nearly line regular graphs and their reconstruction, (ii) On reconstructing separable digraphs.

SHERI H. C. RAMANNA, Management Consultant and Managing Director, Management and Industrial Consultant (P) Ltd., Bangalore (30 July 1979). *Lecture* : Top management control (Creative control—a new concept).

SHERI B. S. RAMANANDA, Technical Information Officer, Hindusthan Machine Tools Ltd., Bangalore (May-June 1979). *Course of 10 lectures* : Industrial information services (DRTC, Bangalore Centre).

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SRI M. V. RAMANATHAN, Technical Information Centre, Hindusthan Machine Tools Ltd., Bangalore (June 1979). *Courses of 8 lectures*: Translation services (DRTC, Bangalore Centre).

SRI K. K. RAO, Osmania University, Hyderabad (25-29 February 1980). *Lecture*: Matroid representation and projective geometry.

DR. P. SOMESWAR RAO, Economic Council, Canada (17-22 September 1979). *Lectures*: (i) Modelling and the challenges, (ii) Lagging productivity growth in the industrialised countries (Economic Analysis Unit, Bangalore Centre).

PROFESSOR BRUCE RICHMOND, Faculty of Mathematics, University of Waterloo, Canada (1 November 1979-20 December 1979).

PROFESSOR D. K. ROY CHOUDHURY, Ohio State University, Columbus, Ohio, USA (24-29 February 1980). *Lectures*: (i) Group divisible difference sets and their multipliers, (ii) Affine triple systems (Special invited address in the Symposium on Combinatorics and Graph Theory).

DR. D. N. SAKENA, Joint Director, Population Research Centre, Lucknow (18 April 1979). *Seminar*: Role of demographers in the evaluation of health services of Government of India.

PROFESSOR AMABYTA SEN, Nuffield College, Oxford, U.K. (4 July 1979). *Seminar*: Description as choice.

DR. P. K. SEN, University of North Carolina, USA (20 August 1979). *Lecture*: Sequential point estimation in the non-parametric case.

DR. S. N. SEN, Joint Director, Directorate of Statistics and Evaluation, Government of Bihar, Patna. *Lectures*: (i) Method of estimation of the effective number of factors from the components of genetic variances, (ii) Selective of the breeding population.

SRI I. N. SENGUPTA, Scientist-in-Charge, Documentation and Library Division, Indian Institute of Experimental Medicine, Calcutta (8 February 1980). *Lecture*: Role of citation analysis in determining the most significant periodicals in any scientific discipline. (DRTC, Bangalore Centre).

PROFESSOR J. J. SIEDAL, Department of Mathematics, University of Technology, Eindhoven, Netherlands (23-29 February 1980). *Lectures*: (i) The Football, (ii) Two-graphs (Special invited address in the Symposium on Combinatorics and Graph Theory).

PROFESSOR J. SRITHURAMAM, Florida State University, U.S.A., Visiting Professor, Stat.-Math. Unit, Bangalore Centre (Arrived 17 August 1979). *Lecture*: Random measures with applications to Bayesian analysis.

PROFESSOR R. SUMIZU, Institute of Statistical Mathematics, Japan (7-11 April 1979). *Lecture*: Lack of memory property of exponential distributions.

DR. N. M. SIVONI, School of Mathematics, Tata Institute of Fundamental Research, Bombay (1 November 1979-31 December 1979 & 25-29 February 1980). *Lectures*: (i) How to count Latin squares, (ii) The minimal forbidden sub-graphs for generalised line-graphs.

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PROFESSOR V. T. SOS, Hungarian Academy of Sciences, Budapest (25-29 February 1980). *Lectures* : (i) Combinatorial aspects of diophantine approximation (Special invited address in the Symposium on Combinatorics and Graph Theory). (ii) On the number of one-coloured edges in Ramsey colourings.

MR. SUDHARAN, Indian Institute of Technology, Madras (25-29 February 1980). *Lecture* : On the (4,3) subgraph conjecture.

DR. K. S. SRIKANTA, Population Council, New York; Consultant, Population Division, United Nations (13 November 1979). *Seminar* : Policy research on population problems in India.

PROFESSOR S. S. SRIKHANDR, Department of Mathematics, Centre for Advanced Studies of Mathematics, Bombay University (25-29 February 1980). *Lecture* : Embedding of designs and strongly regular multigraphs (Special invited address in the Symposium on Combinatorics and Graph Theory).

SRI N. SRINIVASAN, Indian Institute of Technology, Madras (25-29 February 1980). *Lecture* : Extremal problems on geodesic graphs.

MR. SUDHARSANAM, National College, Tiruchipalli (25-29 February 1980). *Lecture* : Cycle mappings of graph.

SRI H. SUBRAMANIAN, Birla Institute of Technology, Pilani (25-29 February 1980). *Lecture* : On certain difference sets.

DR. G. TAGUCHI, International Expert on Quality Control from Japan, came as consultant to the SQC Division (18-23 June 1979). He organised in Bangalore a workshop where four live problems were discussed. He held discussions with the staff members and explained the concepts of computer-aided design, system design and signal noise ratio. *Lecture series* : (i) On the line and off the line QC and quality evaluation, (ii) Introduction to quality control and quality evaluation.

SRI K. TRULASRAMAN, Indian Institute of Technology, Madras (25-29 February 1980). *Lecture* : Analysis of a spanning tree enumeration algorithm.

DR. B. D. TIKKIWAL, Department of Statistics, University of Rajasthan, Jaipur (17 December 1979). *Lecture* : Problem of sampling finite populations.

DR. G. M. TUMCAN, Technical University, Research Laboratories, Faculty of Mining, Kosice, Czechoslovakia (22 November 1979-23 December 1979). *Lecture* : Some problems of size distribution reconstruction in steriology.

PROFESSOR D. S. TRACY, University of Windsor, Canada (8-9 February 1980). *Lecture* : Expectation and unbiased estimation in sampling from finite population.

MR. M. N. VARTAK, Indian Institute of Technology, Bombay (25-29 February 1980). *Lecture* : On the adjugate of the symmetrical balanced incomplete block design with $k = 1$. (Special invited address in the Symposium on Combinatorics and Graph Theory).

PROFESSOR GEORGE WALD, Nobel Laureate (Physiology & Medicine), Harvard University, USA (7-9 November 1979). *Lecture* : Life in the universe.

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DR. H. B. WALKER, Karnatak University, P.G. Centre, Culbargh (25-28 February 1980). *Lectures* : (i) Domination number of a graph and other graph-theoretic parameters, (ii) On star-partition number of a graph.

PROFESSOR A. G. DE WILDE, Director, Medical Faculty, Department of Anatomy and Embryology, State University, Netherlands (4 March 1980). *Seminar* : Genetic aspects of finger patterns.

III. The following are some of the visitors who came to the Institute for short periods on different assignments.

DR. G. L. BADAM, Reader in Paleontology, Deccan College, Post-graduate and Research Institute, Pune, came to study some Pleistocene vertebrate fossils from the Pranhita-Godavari Valley (19-24 January 1980).

DR. CRAIG C. BLACK, Director Carnegie Museum of Natural History, Pittsburgh, U.S.A., had discussions with Dr. B. P. Adhikari, Director, ISI. (13 February 1980).

PROFESSOR B. H. BRANDSEN, Head, Department of Theoretical Physics, Durham University, U.K. (January 1980).

DR. DONALD W. DAVIES, Superintendent, Division of Computer Science, National Physical Laboratory, U.K., Member, Technical Committee, International Federation for Information Processing (I.F.I.P.) (February 1980).

PROFESSOR ANDRÉ GUNDER FRANK, Director, School of Development Studies, East Anglia, U.K. (19-23 March 1980).

MS. DENNIS GUNTON, Chief Librarian, British Libraries in India (12 May 1979) (DRTC, Bangalore Centre).

PROFESSOR S. HADZIVUKOVIC, Department of Statistics, Institute of Agricultural Economics, Faculty of Agriculture, University of Novi Sad, Yugoslavia; accompanied by PROFESSOR S. REMLIN, Department of Marketing Institute of Agricultural Economics (15-18 December 1979).

PROFESSOR D. W. HISLOP, Consultant, Intermediate Technology Development Group, London (28 March 1980).

DR. MOHAMMAD KAYSAR HOSSAIN, Chairman, Department of Economics, Jahangirnagar University, Dacca, Bangladesh; accompanied by 11 students (18 May 1979).

SRI P. N. KAULA, Dean and Head, Department of Library Science, Banaras Hindu University, Varanasi (24 July 1979) (DRTC, Bangalore Centre).

MS. IVOR KEMP, Chief Librarian, British Council Libraries in India (10 July 1979 & 6 February 1980) (DRTC, Bangalore Centre).

DR. OGA LENDWAY, Consultant, Food and Agricultural Organisation (20 July 1979) (DRTC, Bangalore Centre).

DR. JOHN MACBEOB, Economist, World Bank, U.S.A. (26-27 July 1979). (*Economic Analysis Unit, Bangalore Centre*).

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SHI AMRIT MAHAL, Senior Training Expert, Economic & Social Commission for Asia & Pacific (6 March 1980).

MR. A. H. MEKRAWI, Director, Documentation and Industrial Information, Industrial Development Centre for Arab States (IDCAS), Tunis, Tunisia, came for discussions on the possibility of cooperation by DRTC in developing information manpower for the Arab States (2 February 1980). (DRTC, Bangalore Centre).

MR. S. M. MOHSIN, Head, Department of Statistics, Shia Degree College, Lucknow (7 April 1979).

MR. M. NAGASANA, Science journalist (electronics), and MR. A. OKA, science journalist (atomic energy) from 'Asahi Shimbun', Japan (6 April 1979).

AIR VICE MARSHAL V. S. NARAYAN, Director, Defence Research & Development Laboratory, Hyderabad (18 June 1979) visited Economic Analysis Unit, Bangalore Centre, for discussions on the possibility of ISI undertaking research projects on urban wastes.

PROFESSOR A. NEELAMBEGHAN, Project Coordinator, UNESCO-UNDP Project on Education in Library and Information Science, University of Philippines, Quezon City, Philippines (January 1980). Lecture : UNESCO's information programme (DRTC, Bangalore Centre).

DR. GUNTHER NOBIS, Director, Alexander Koeg Zoological Museum, Bonn, Federal Republic of Germany (22 October 1979).

PROFESSOR N. W. PIRIE, F.R.S., Visiting Professor, Reading University, U.K. reviewed the activities of the Loaf Protein Unit and delivered a lecture at the Asiatic Society. (18-21 April 1979).

MR. G. RANSON, Consultant in Industrial Information, London (9 November 1979). (DRTC, Bangalore Centre).

SRI R. SAMPATHUMARAN, Chief Electoral Officer, and Special Secretary to Mysore Government, Administration Reforms Division (3 May 1979). Lecture : Improvement in administration (Karnataka Branch).

MR. PAUL E. SOTUTU, Chief Projects Officer, Education & Training Division, C.P.T.C., Commonwealth Secretariat, London (12 October 1979).

THIRD INDO-US. WORKSHOP ON INFORMATION SCIENCE, U.S. delegates :—(i) Dr. M. D. Cooper, University of California, Berkeley, (ii) Mr. W. R. Nugent, Library of Congress, (iii) Dr. M. Yovits, Purdue University, (iv) Mr. P. Lundo, Institute of Technology, Georgia University, (v) Mr. V. E. Palmour, King Research Company (18 March 1980). (DRTC, Bangalore, Centre).

DR. WOLFGANG USFER, Department of Statistics, University of Dortmund, Federal Republic of Germany (4 September 1979).

XIV. HONOURS, AWARDS AND SPECIAL ASSIGNMENTS

15.1 Honours and Awards : Shri Brahmananda Bhattacharyya, Lecturer, Fakirchand College, Diamond Harbour, who worked in particle physics under the supervision of Professor P. Bandyopadhyay (Electronics) was awarded the Ph.D. degree, Calcutta University.

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Dr. N. S. Iyengar (*Economic Analysis, Bangalore Centre*) was awarded the Mahalanobis Memorial Medal (1978) for his outstanding contribution to Quantitative Economics, instituted by the Indian Econometric Society.

Shri Harihar Sarkar, Lecturer, Santipur College, who worked on particle physics under the supervision of Professor P. Bandyopadhyay (*Electronics*) was awarded the Ph.D. degree, Calcutta University.

15.2 *Special Assignments* : Shri Durgaprasad Bhattacharyya (*Pre-Census Population Studies*) continued to serve as (i) Member, Advisory Committee on Historical Statistics of India, and (ii) Secretary, Socio-economic Research Institute, Calcutta.

Dr. N. Bhattacharyya (*Economic Research*) continued to serve, as a representative of the ISI, on the following :—

- (i) Statistical expert in the project "Road User Cost Study", undertaken by the Central Road Research Institute.
- (ii) Member, Governing Council, National Sample Survey Organisation.
- (iii) Member, Working Group, set up by the Government of India, to review the national statistical system.
- (iv) Member-Secretary, Board of Directors, International Statistical Education Centre.
- (v) Co-editor, *Sankhya*, Series C (Quantitative Economics).
- (vi) Member, West Bengal Government Expert Committee set up for reviewing the activities of the Bureau of Applied Economics and Statistics.

Dr. D. K. Bose (*Economics Research*) continued to serve as (i) Member, Eleventh Annual Power Survey Committee, Ministry of Energy, Government of India, (ii) Member, Indian National Committee for World Energy Conference.

Dr. D. K. Bose and Shri N. K. Chatterjee (*Economic Research*) are serving as members, State Level Co-ordination Committee for Integrated Rural Development Programme, Government of West Bengal.

Shri N. K. Chatterjee (*Economic Research*) continued to serve as member, Pay Commission, for the revision of pay scales for the employees of the West Bengal Government.

Professor D. Dutta Mazumdar (*Electronics, & Communication Science*) was elected as :

- (i) Member, Academic Council, Jawaharlal Nehru University, New Delhi.
- (ii) Member, Advisory Committee, Regional Computer Centre, Jadavpur.
- (iii) Chairman and Member, National Council, Calcutta Chapter of Computer Society of India.
- (iv) Liaison Officer in India, World Organisation of Cybernetics and Systems.
- (v) Member, Executive Committee, Calcutta Centre, Institute of Electrical & Electronics Engineering.

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He continued as :

- (i) Member, Advisory Committee, Computer Centre, Indian Institute of Technology, Kharagpur.
- (ii) Member, Technical Committee on Digital Systems Design, International Federation for Information Processing.

Shri A. B. Gupta (*Physics*) was admitted to the (i) Life Membership, Indian Physics Association; (ii) Associate Membership, Indian Association of Dermatologists, Venereologists and Leprologists.

Dr. N. S. Iyengar (*Economic Analysis, Bangalore Centre*) was a member of Task Force constituted by the Planning Commission, Government of India, and their report "Projections of minimum needs and effective consumption demands" is under print.

Dr. N. S. Iyengar was elected to the Executive Committee, Indian Association for Research in National Income & Wealth, in January 1980.

Dr. S. L. Jain (*Geological Studies*) continued to serve as Chairman, Working Group on Vertebrate Palaeontology under the Sub-Commission on Gondwana Stratigraphy (*IUGS*).

Shri T. Maitra (*Applied Statistics, Survey & Computing*) served as the working group of Experts for planning the Survey on Special Consumption to be taken up by the National Sample Survey Organisation in its thirtyfifth round commencing from July 1980.

Shri K. C. Malhotra (*Anthropometry & Human Genetics*) became a

- (i) Member, Editorial Boards, *South Asian Anthropologist*, *The New Biologist* and *Population Genetics of the People of India*.
- (ii) Member, National Genetic Conference, to be held at Delhi in 1980.
- (iii) Member, Panel of Reviewers, *Sociological Bulletin*, published by Indian Sociological Society.

Dr. K. C. Malhotra worked as Visiting Scientist, Centre for Theoretical Studies, Bangalore, 20-29 July 1979.

Professor A. Sen (*Electronics*) continued to serve as member, Science & Technology Committee, Government of West Bengal, since July 1978.

Dr. B. P. Sinha and Dr. P. K. Srimani (*Electronics*) were awarded the Humboldt fellowship by Alexander Von Humboldt Foundation and went to West Germany. Dr. Sinha left in October 1979 and Dr. Srimani in February 1980. Both of them are expected to work there for about 18 months.

Shri S. Maitai (*Leaf Protein*) was elected Executive Member, Indian Society of Agricultural Chemists, for the term 1980-82.

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XVI. SCIENTIFIC TOURS AND ASSIGNMENTS ABROAD

Shri A. K. Adhikari (*Applied Statistics, Surveys & Computing*) visited Hungary at the invitation of the Institute of Cultural Relations, Budapest, under the Indo-Hungarian Cultural Exchange Programme, 14 September 1978-26 October 1978. During his stay, he visited the Eotwas Lorand University (Budapest), Technical University (Budapest), and the Computer and Automation Research Institute (SZTAKY). He also visited the Institute of Weather Forecasting, Central Physics Research Institute and Mathematical Institute of the Hungarian Academy of Sciences. He delivered three seminars.

Professor B. R. Bhat (*Stat.-Math., Bangalore*) visited the USSR for three months from 25 September 1978 under the Indo-Soviet Collaborative Programme. He gave seminars at the Lithuanian Academy of Sciences, Leningrad, Ukrainian Academy of Sciences, Kiev, and Steklov Institute (Moscow & Leningrad).

Professor G. Bhattacharyya and Shri F. J. Devadasan (*DRTC, Bangalore*) participated in the UNESCO Regional Training Course in Computerised Documentation System/Integrated Set of Information Systems (CDS/ISIS), Laguna, Philippines, 15 October 1978-2 November 1978.

Dr. N. Bhattacharyya (*Economic Research*) attended, on behalf of the International Statistical Education Centre (ISEC), the fourth international meeting of ISEC Directors organised by the International Statistical Institute, Morocco, May 1978.

Dr. Sankar Chatterjee (*Geological Studies*) attended the Annual Meeting, Society of Vertebrate Paleontology, Pittsburgh, USA, 8-10 November 1978. He presented a paper.

Dr. Arijit Chaudhury (*Applied Statistics, Surveys & Computing*) visited the University of Lund and Umea (Sweden) and the Technical Universities in Stockholm and Suft (Netherlands), March & June 1978. He delivered seven lectures.

Dr. A. Chaudhury went to the University of Montreal, Canada, on 27 February 1980.

Professor J. K. Ghosh (*Stat.-Math.*) visited the Department of Statistics, University of Dar-es-Salaam, Tanzania, 13 March-24 April 1980, to act as an external examiner in the Ph.D. Committee. During his stay, he delivered lectures on "Small sample asymptotic" and "Statistical models of sediment transport". He also visited the University of Nairobi, Kenya, to act as an external examiner.

Shri N. K. Jaiswal (*Stat.-Math., Delhi Centre*) attended the Symposium on Queuing Theory and Related Topics, 9-17 January 1980, Karpacz, Poland, and chaired a session on "Reliability Modelling".

Shri T. Maitra (*Applied Statistics, Surveys & Computing*) participated in a seminar on Employment Expansion in South Asian Agriculture, Dacca, 20-23 November 1978.

Shri D. Majumdar (*Stat.-Math.*) attended a UNESCO-sponsored Summer School on Data Analysis at the International Centre for Pure and Applied Mathematics (ICPAM), Nice, France, 10-30 September 1978.

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Shrimati Alokananda Mitter (*Linguistic Research*) went on a scientific assignment to Yugoslavia (7 November 1979-2 January 1980), to work at the Faculty of Defectology, Belgrade University and the Institute for Experimental Phonetics & Speech Pathology, Belgrade. During her visit, she studied modern methods in speech pathology, and visited schools for (a) mentally-retarded children, (b) hearing-impaired children, and (c) modern experimental schools for normal children. She also studied methods used for psycholinguistic testing of mentally-retarded children and normal children.

Professor Ramkriahna Mukherjee (*Sociology*), Distinguished Scientist, left India for the United States on 1 April 1979 for a periodical teaching assignment at the Department of Sociology, State University of New York at Binghamton. On his way back, he attended the Seminar on *Maison des Sciences Humaines*, France and the Colloquium on the University of Calabria, Cosenza, Italy. Professor Mukherjee returned to India at the end of June 1979.

Dr. S. K. Pal (*Electronics & Communication Science*) proceeded to the Imperial College, London, on a Commonwealth Scholarship, for pursuing his research on pattern recognition and image analysis.

Shri S. M. Sundara Raju (SQC) went abroad in December 1979 to Iraq on a UNIDO assignment for one year.

Dr. K. P. S. Bhaakara Rao (*Stat. Math.*) visited the Mathematical Institutes of the Czechoslovak Academy of Sciences, Prague, and the Slovak Academy of Sciences, Bratislava, on a Cultural Exchange Programme for one month during November-December 1979. He also visited the Institute of Mathematics, Polish Academy of Sciences at Warsaw and Wrocław for one month during January-February 1980. During November 1979-February 1980, Dr. Rao visited and gave lectures at the Department of Probability and Statistics, The University, Sheffield, U.K.; Charles University, Prague, Czechoslovakia; Comenius University of Bratislava, Czechoslovakia; Warsaw Technical University, Poland; University of Wrocław, Poland; Institute di *Matematica Applicata*, University Degli Studi di Roma, Rome, Italy.

Dr. B. V. Rao (*Stat. Math.*) visited the Department of Mathematics, faculty of Engineering, Keio University, Yokohama, Japan, 11 January 1979-27 April 1979. While at Keio, he gave a series of lectures on Predictable Processes. He attended a series of lectures on Chaos Theory, and another series on Linear Processes. He lectured at the Institute of Statistical Mathematics, Tokyo Institute of Technology, Tokyo Metropolitan University, Kobe University, Hiroshima University and Osaka City University. He spent ten days at the Osaka City University. Topics of his lectures were Non-standard Analysis, Axiom of Determinateness, Borel Spaces, Perfect Measures, Partitions of Polish Spaces, Uniformization and Reduction Principles, and Marginal Sufficiency. He visited the Tokyo Institute of Fisheries and his work with S. Yamada of the Institute appeared in the *Osaka Mathematical Journal*. He visited the Hoso University and had useful discussions with Professors M. Mondo and H. Tanaka on Descriptive Set Theory. He gave an invited talk on Selection Theorems at the Hakone Conference on the Applications of Set Theory organized by Professor T. Tsugue.

Dr. A. K. Roy (*Stat. Math.*) spent the academic year September 1978-August 1979 at the University College, Swansea, Wales (U.K.) with a Senior Visiting Fellowship from the Science Research Council of Great Britain.

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He gave invited lectures at the Universities of Oxford, Hull, Sussex and Erlangen (West Germany).

Dr. J. Roy (*Applied Statistics, Surveys & Computing*) attended the Forty-second Session, International Statistical Institute, Manila, 4-14 December 1979.

Dr. Bimal Kumar Sinha (*Stat. Math.*) worked as a Visiting Scientist for six months from 1 September 1979 to 29 February 1980 at the Ecole Polytechnique, Montreal, Canada and the Université de Montreal, Canada.

XVII. SCIENTIFIC ASSIGNMENTS IN INDIA

Shri P. Bandyopadhyay (*Electronics*) attended and gave a talk at the Symposium on High Energy Physics organised by the North Bengal University in May 1979.

Professor B. R. Bhat (*Stat. Math., Bangalore Centre*) attended the following and gave talks :—

- (i) All India Seminar on "Non-parametric statistics and inference under order alternatives", organised by the Delhi University, 10-14 April 1979.
- (ii) Symposium on Statistical Inference and Design of Experiments organised by the Rajasthan University, Jaipur, 1-8 April 1979.
- (iii) Indian Science Congress, Calcutta, February 1980. He presided over the Statistics Section and delivered the presidential address.

Shri Durgaprasad Bhattacharyya (*Pre-Census Population Studies*) participated in the following and presented papers :

- (i) Seminar on Sociological Writing in Bengali, 1818-1947, Calcutta, 7-8 July 1979.
- (ii) Seminar on Economic History of India, Calcutta, 8 July 1979.
- (iii) Conference on Population Dynamics and Rural Development, Bombay, 28-30 December 1979.
- (iv) National Seminar on Science and Technology, New Delhi, 11-13 February 1980.

Professor G. Bhattacharyya (*DRTC*) participated and contributed papers at the :

- (i) UNESCO Regional Meeting on Development of Scientific and Technological Information Co-operation Programmes in South and Central Asia, New Delhi, 26-28 September 1979 (as a nominated delegate of Secretary, Department of Statistics).
- (ii) Round Table on Information System for Regional Centre for Technology Transfer of the ESCAP Region, 15 February 1980.

Dr. N. Bhattacharyya (*Economic Research*) attended the Fourth Conference, Central and State Statistical Organisation, Lucknow, 20-24 September 1979.

Sarvasri S. K. Biswas, P. Chakraborti and T. N. Ghosh (*Sociology*) attended the :

- (i) Seminar on Sociology in Bengali, Calcutta, 7-8 July 1979.
- (ii) Colloquium on Anthropology in India, Calcutta University, 20-22 July 1979.

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Shri S. K. Biswas (*Sociology*) attended the :

- (i) Seminar on Operation Barga, Indian School of Social Sciences, Calcutta, 8 September 1979.
- (ii) Seminar on Cultural Trait and Culture Area Survey, Anthropological Survey of India, Calcutta, 13-15 September 1979.

Dr. D. K. Bose (*Economic Research*) attended the :

- (i) Conference on Population Dynamics and Rural Development, Bombay, 28-30 December 1979.
- (ii) UNITAR Conference on Third World and Future of Asia, New Delhi, 11-17 March 1980.

Shri R. L. Brahmachary (*Embryology*) attended the International Cell Biology Conference organised by the Calcutta University, January 1980. He read a paper.

Dr. S. Chattopadhyay (*Economic Research*) attended the second session, long-term study project on Indian economy undertaken at the Institute of Development Studies, Madras, 28-30 January 1980.

Shri K. Chattopadhyay (*Sociology*) attended the :

- (i) Colloquium on Anthropology in India, Calcutta University, 20-23 July 1979.
- (ii) National Symposium on Social Constraints of Resource Administration for Agriculture and Community Development, Kriahi Vigyan Kendra, Midnapore, 16-17 February 1980. He acted as chairman of the first session.

Dr. P. C. Das Chaudhuri (*Entomology*) attended, as a delegate of I.S.I., the International Symposium on Hundred Years of Malaria Research, Calcutta, 17-19 January 1980.

Shrinati Rama Deb Roy (*Pre-Census Population Studies*) attended the National Seminar on Science and Technology, New Delhi, 11-13 February 1980.

Sarvaswari A. K. Dutta, S. Roy and F. B. Chowdhury (*Electronics & Communication Science*) participated in the Fifteenth Annual Convocation, Computer Society of India, Bombay, 8-11 February 1980.

Sarvaswari A. K. Dutta and B. B. Chaudhuri (*Electronics & Communication Science*) participated in the Twenty-third Convention, Institute of Electronics & Telecommunication Engineers, New Delhi, 12-15 January 1980. Both of them presented papers.

Professor D. Dutta Majumdar, Shri A. K. Dutta, Shri S. Roy, Shri B. B. Choudhuri and Dr. S. K. Pal (*Electronics & Communication Science*) conducted a familiarization course in pattern recognition and image analysis for scientists and engineers of Defence Electronics Applications Laboratories, Dehra Dun, 10-20 June 1979.

Professor D. Dutta Mazumdar, Shri A. K. Dutta and Shri B. B. Chaudhuri (*Electronics & Communication Science*) participated in the Workshop on Remote Sensing Techniques and Applications, organised by the Indian Council of the Institute of Electrical & Electronics

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Engineers, New Delhi, 5-7 November 1979. Professor Mazumdar was a panelist on the Applications of Remote Sensing to Defence.

Shrimati Anjali Ghosh (*Psychometric Research*) attended a Symposium on Trends and Status of Educational Psychological Testing in India, Dehra Dun, 2-4 October 1970, and presented a paper.

Shri M. A. Gopinath (*DRTC*) attended the following and presented papers :

- (i) First Annual Conference, Indian Association of Academic Librarians, Delhi, 16-18 April 1979. He also attended the Second Annual Conference, Tirupathi, 17-20 January 1980.
- (ii) Seminar of Indian Association for Special Libraries & Information Centres, Roorkee, 26-30 December 1979.
- (iii) National Seminar on Health Sciences Libraries in India, Bangalore, 6 February 1980.
- (iv) Round Table on Information Systems for Regional Centre of ESCAP Region, 15 February 1980.

Shri A. B. Gupta (*Physics*) attended and presented papers at the :

- (i) Seventh and Eighth Annual Conferences, Indian Association of Dermatologists, Venereologists and Leprologists, Srinagar, 21-23 May 1979, and Panaji, Goa, 22-24 January 1980.

Dr. I. S. Iyengar (*Economic Analysis, Bangalore Centre*) participated in the following :

- (i) Eighteenth Annual Conference, Indian Econometric Society, Srinagar, 23-26 May 1979.
- (ii) Seminar on Food, Population and Energy, Madras, 10-11 July 1979.
- (iii) Social Science Area Seminar, Indian Institute of Management, Bangalore, 23 August 1979. He gave a talk.
- (iv) Thirty-ninth Annual Conference, Indian Society of Agricultural Economics, Bangalore, 18-20 January 1980. He chaired a session on Inter-sector Linkages.
- (v) Twelfth Annual Conference, Indian Association for Research in National Income & Wealth, Bangalore, 18-21 January 1980.

Dr. K. C. Malhotra (*Anthropometry*) attended the following :

- (i) Seminar on Modern Biology Series : Evolution of Social Behaviour, Mahabaleshwar, 14-27 October 1979. He was a Faculty Member.
- (ii) Sixth Annual Conference, Indian Society of Human Genetics, Hyderabad, 8-10 February 1980. He chaired the plenary session, and delivered the presidential address.
- (iii) National Symposium on Child with Genetic Defects, Hyderabad, 8 February 1980.
- (iv) Ninth Conference, Ethnological Society of India, Madurai, 11-13 February 1980.

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- (v) International Symposium on Dermatoglyphics, Patiala, 18-23 February 1980.
- (vi) International Symposium on Human Growth, Patiala, 18-23 February 1980.
- (vii) National Symposium on Human Variation, Patiala, 18-23 February 1980. He chaired the session on Population Structure.
- (viii) Sixth National Conference, Indian Society of Human Genetics, Hyderabad, 8-10 February 1980. He presented papers.
- (ix) Professor K. P. Chattopadhyay Memorial Colloquium, Department of Anthropology, Calcutta University, 20-22 July 1979.

Shri S. Matai and Shri D. K. Bagechi (*Leaf Protein*) attended the Twelfth Convention, Indian Society of Agricultural Chemists, Durgapur, 27-28 November 1979. They presented a paper.

Shri B. N. Mukherjee (*Anthropometry*) attended and presented papers at : (i) National Symposium on Child with Genetics Defects, and (ii) Sixth Annual Conference, Indian Society of Human Genetics, 8-10 February 1980, Hyderabad, (iii) International Symposium on Human Growth, and (iv) All India Seminar on Human Variation, 18-23 February 1980, Patiala.

Professor M. G. Nadkarni (*Stat. Math.*) attended the Conference on Functional Analysis and its Applications to Mathematical Physics, Delhi, 17-22 December 1979, and gave two talks.

Dr. Kanti Pakrasi (*Anthropometry*) attended the International Workshop on 'Graduate Employment & Higher Education—The Case of West Bengal', Calcutta, 18-19 February 1980, organized jointly by International Institute for Educational Planning (UNESCO), Paris, Calcutta University Department of Statistics, and the University Grants Commission. He worked as the rapporteur in the session on Review of the Study.

Dr. M. N. Pal (*Economic Research*) attended the Twelfth Regional Science Seminar, Regional Science Association of India, Kharagpur, 21-22 December 1979.

Dr. Bins Roy (*National Income*) attended and presented papers at the :

- (i) Eighteenth Conference, Indian Econometric Society, Srinagar, 24-27 May 1979.
- (ii) Twelfth Annual Conference, Indian Association for Research in National Income and Wealth, Bangalore, 18-21 January 1980.

Dr. J. Roy (*Applied Statistics, Surveys & Computing*) participated in the Workshop-Seminar on Monte Carlo Methods and their applications at the Indian Institute of Science, Bangalore, 17-22 December 1979.

Shri B. N. Sarkar (*Demography*) attended the :

- (i) Seminar on Population Policy and Population Research, Bhubaneswar, 14-18 April 1979.
- (ii) Fifth Annual Conference, India Association for Study of Population, Bombay, 28-30 December 1979.
- (iii) Symposium on Advances in Methods of Data Collection, Validation, Storage, Retrieval and Analysis, Calcutta, 17-20 January 1980.

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Shri S. Sotharama (*DRTC, Bangalore Centre*) attended the:

- (i) National Seminar on Health Sciences Libraries in India, Bangalore, 5 February 1980.
- (ii) Workshop/Seminar on Medical Library and Information System in the Western Region, conducted by the Institute of Research in Reproduction, Bombay, 28-30 November 1979.

Professor J. Sethuraman (*Stat. Math., Bangalore*) attended the Fortyfifth Annual Conference, Indian Mathematical Society, Ranchi, 28-30 December 1979. He delivered a talk.

Dr. T. P. Tripathi (*Stat. Math.*) attended the Thirtythird Annual Conference, Indian Society of Agricultural Statistics, Trichur, 21-23 December 1979.

The undermentioned staff members attended the:

Sixty-seventh Session, Indian Science Congress, Calcutta 1-5 February 1980.

1. Professor B. R. Bhat (*Stat. Math., Bangalore Centre*) presided over the Statistics Section, and delivered the Presidential Address.
2. Dr. D. K. Bose (*Economic Research*).
3. Shri B. Chakraborty* (*Demography*).
4. Dr. P. Mukhopadhyay* (*Applied Statistics, Surveys & Computing*).
5. Shri B. N. Sarkar* (*Demography*).

XVIII. EIGHTY-SIXTH BIRTH ANNIVERSARY OF LATE PROFESSOR P. C. MAHALANOBIS

On the occasion of the eighty-sixth birth anniversary of late Professor P. C. Mahalanobis, founder of the Indian Statistical Institute, a meeting was held at Baranagar on 29 June 1979. Shri Subimal Dutt, President of the Institute, presided.

Speaking on the occasion, Professor Nihar Ranjan Ray, the eminent historian, said that Professor Mahalanobis had inherited the liberal, humanist traditions of the eighteenth century. His broad interests are not generally found in scientists of today. Professor Mahalanobis sometimes digressed from his specialised field, but he was not a lesser scientist for this reason.

Shrimati Nirmal Kumari Mahalanobis handed over a gift of about 3,000 valuable books, the personal collection of Professor Mahalanobis to Dr. A. Mitra, Officiating Director of the ISI.

An exhibition organised on the occasion depicted the current scientific research activities of the Institute and also displayed photographs on different aspects of Professor Ma Mahalanobis's career.

* Denotes presented papers.

Part III : Administration and Office-bearers

XIX. GENERAL ADMINISTRATION

19.1 *Membership* : During the year, 43 ordinary members of the Institute were enrolled. Three ordinary members became life members while two life members died. Three institutional members were enrolled. Thus, the membership position as on 31 March 1980 was 484 (Ordinary-323; Honorary Life-4, Life-126 and Institutional-12). During the year, 248 student members were enrolled for a one-year term.

19.2 *General Meetings* : Two Annual General Meetings of members, Indian Statistical Institute, were held on 17 April 1979 and 16 January 1980.

19.3 *Meetings of the Council* : The Council of the Institute met four times on (i) 16 April 1979, (ii) 3 August 1979, (iii) 19 October 1979 and (iv) 10 January 1980.

19.4 *Meetings of the Finance Committee* : The Finance Committee met four times during the year on (i) 16 April 1979, (ii) 3 August 1979, (iii) 18 October 1979, and (iv) 9 January 1980.

A list of names of the President, Chairman and members of the Council of the Institute together with a list of different Committees are given in Chapter XX.

19.5 *Institute Staff* : The following senior members of the staff have been functioning in the posts mentioned during the year. (i) Dr. B. P. Adhikari, M.Sc. (Cal.), Dr. ex.Sc. (Paris), became the Director on 4 August 1979. Till then, Dr. Ashok Mitra, M.Sc., Ph.D., had been the Officiating Director, (ii) Dr. K. R. Parthasarathy, became Acting Head, Delhi Centre, from 13 August 1979 in place of Dr. S. K. Mitra. He was appointed Head of Delhi Centre for 5 years from 6 November 1979, (iii) Dr. T. Kriahnan, continued as the Dean of Studies, (iv) Shri N. Srinivasan, Technical Officer (SQC), who had been appointed as Officer-on-Special Duty (Administration & Finance) in August 1978 continued to function in the same post.

19.6 *New Appointments* : The senior staff of the Institute was strengthened during the year by the addition of the following :

1. Shrimati Aruna Arora, M.Lib.Sc., Assistant Librarian, Delhi Centre.
2. Shri Subrata Bhattacharyya, M.Sc., Lecturer, Electronics Unit.
3. Dr. B. S. Dandapat, M.Sc., DITT, Ph.D., Lecturer, Electronics Unit.
4. Shri Arun Kumar Do, M.E. (Electronics), Computer Engineer, Electronics & Communication Science Unit.
5. Dr. Bhaakar Dutta, M.A., Ph.D., Associate Professor, Social Science Division, Delhi Centre.
6. Shri Shovanlal Kundu, M.E. (Tech.), Computer Engineer, Electronics & Communication Science Unit.
7. Dr. Ashim Mallick, M.Sc., Ph.D., Lecturer, Stat.-Math. Division.
8. Dr. Himadri Masumdar, M.Sc., Ph.D., Lecturer, Electronics Unit.

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9. Dr. Partha Mukherjee, M.A., Ph.D., Professor, Sociological Research Unit.
10. Shri S. A. Lakshmi Narayan, B.E., Computer Engineer, Computer Science Unit.
11. Shri P. R. Nayak, B.Tech., Ph.D., Lecturer, Delhi Centre.
12. Dr. T. Parthasarathi, M.Sc., Ph.D., Professor, Division of Theoretical Statistics & Mathematics, Delhi Centre.
13. Dr. Ajit Kumar Paul, M.Tech., Ph.D., Computer Engineer, Electronics Unit.
14. Dr. K. Ramamurty, M.Sc., Ph.D., Lecturer, Bangalore Centre.
15. Shri Arunabha Sen, B.E., Computer Engineer, Computer Science Unit.
16. Shri Bikash Kumar Sinha, M.Sc., Ph.D., Associate Professor, Stat.-Math. Division.
17. Dr. K. S. Vijayan, M.Sc., Ph.D., Associate Professor, Computer Science Unit.

Medical Officers

1. Dr. D. K. Dasgupta, MBBS, E.C.F.M.G., D.T.M. & H. (Lond.), Resident Medical Officer.
2. Dr. T. K. Saha, MBBS, T.D.D., M.D., Assistant Medical Officer.
3. Dr. John Sarma, MBBS, Assistant Medical Officer.

19.7 *Retirements and Resignations* : The undermentioned members of the senior staff retired, on superannuation.

1. Shri Gourishankar Chatterjee, M.A., Associate Professor, National Income Research Unit.
2. Dr. Ramkrishna Mukherjee, M.Sc., Distinguished Scientist, Sociological Research Unit.
3. Shri S. P. Mukherjee, M.A., B.Com., AICWA, Senior Accounts Officer.
4. Shri R. N. Nath, Accountant.
5. Shri Monoj Noogy, B.A., Dip.Lit.Sc., Deputy Librarian.
6. Dr. S. C. Sen, M.B., D.T.M., Resident Medical Officer.

Resignations :

1. Shri D. V. Nagabhusana, Civil Engineer, Delhi Centre.
2. Dr. A. Radra, Professor, National Income Research Unit.

19.8 *Obituary* : (i) Shri P. R. Nayak, B.Tech., Lecturer, Delhi Centre, died in August 1979, (ii) Shri Modan Mohan Shukla, Senior Technical Assistant, Library, died on 5 October 1979.

19.9 *Land and Construction : Calcutta*

1. *Library Building* : The following were the main developments in the construction of the composite library building during the year.

- (i) The civil construction of the library building upto the fourth floor was completed.
- (ii) Sanitary works for the third and fourth floors were completed at an approximate cost of Rs. 1,48,790/-.

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(iii) Electrical works for the third and fourth floors were completed at a cost of Rs. 78,516.20 p. The work had been entrusted to Messrs. Electrical Construction & Equipment Co., after scrutiny by Messrs. Ballardie Thompson & Mathews (P) Ltd. and approval of the Works Advisory Committee.

(iv) Tenders for the reinforced concrete and g.c.s. building works of the fifth and sixth floors were invited on 30 January 1980. Three firms responded at first, but the tender values in all the cases were considered high. On re-tendering, when four firms responded, the lowest quotation was lower by Rs. 4 lakhs than the previous lowest one. After scrutiny by Messrs. Ballardie Thompson & Mathews (P) Ltd., and on the recommendation of the Works Advisory Committee, the contract was awarded to Messrs. Joshoda Nandan Datta.

Hostel Complex : (i) The construction, including sanitary and electrical works, of the first building of the hostel complex was completed during the year at a total cost of Rs. 26,04,140/- (approx.). (ii) The sketch plan for the second building of the hostel complex has been prepared for approval of the Works Advisory Committee.

Delhi

1. *Staff Quarters :* The construction of staff quarters (Phase I) was completed in all respects and the undermentioned quarters were taken over for occupation in October 1979 : (i) A type (8 flats); (ii) B type (3 flats) and (iii) C type (5 flats).

The energiation of the staff quarters was completed by the Delhi Electric Supply Undertaking in August 1979 at a total cost of Rs. 77,280/-.

2. *Miscellaneous :* The work pertaining to the provision of certain security lights in the campus was completed by Messrs. Anand & Co. at a total cost of Rs. 40,666/-.

Tenders for the construction of a B4 block consisting of six dwelling units (civil engineering works) were invited in December 1979. The work was entrusted to Messrs. H. K. Mondal at a tendered cost of Rs. 5,69,990/-.

XX. LIST OF PRESIDENT, CHAIRMAN AND MEMBERS OF THE COUNCIL,
MEMBERS OF THE COMMITTEES OF THE COUNCIL
AND ACADEMIC COUNCIL

President : Shri Subimal Dutt, ICS (Retd.)

The Council

1. *Chairman :* Shri P. N. Haksar, M.Sc., Bar-at-Law, IFS (Retd.)

Representatives of Government of India (4)

2. (1) Dr. K. C. Sual, Director, Central Statistical Organisation, Department of Statistics, Ministry of Planning.

3. (1) Shri N. K. Panda, Joint Secretary, Ministry of Finance, Department of Expenditure.

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4. (11) Dr. (Mrs.) A. R. Rajeshwari, Principal Scientific Officer, Department of Science and Technology.

5. (10) Shri V. V. Divatia, Executive Director, Reserve Bank of India (Shri K. P. N. Nair, Department of Statistics, Reserve Bank of India, from 3 August 1979).

Scientists not employed in the Institute (7)

Representative of ICSSR (1)

6. Professor Bhabatosh Datta

Representatives of INSA (4)

7. (1) Professor M. S. Narasimhan, School of Mathematics, Tata Institute of Fundamental Research, Bombay.

8. (11) Professor S. S. Shrikhande.

9. (111) Professor B. K. Bachhawat, Director, Indian Institute of Experimental Medicine, Calcutta.

10. (10) Dr. S. C. Bhattacharyya, Director, Bose Institute, Calcutta.

Scientists co-opted by the Council (2)

11. (1) Professor R. P. Bambah, Department of Mathematics, Centre for Advanced Studies in Mathematics, Punjab University.

12. (11) Dr. R. Narasimhan, Head, Computer Group, Tata Institute of Fundamental Research, Bombay (Professor V. Rajaraman, Computer Centre, Indian Institute of Technology, Kanpur, from 3 August 1979).

Elected representatives of the Institute

Members not employed in the Institute (2)

13. (1) Dr. P. K. Bose, M.Sc., Ph.D., FSS (London), Head, Department of Statistics, University of Calcutta.

14. (11) Dr. P. V. Sukhatme, M.A., Ph.D., F.N.A., Honorary Professor of Biometry, Maharashtra Association for Cultivation of Science.

Elected representatives of the employees of the Institute (2)

15. (1) Dr. (Mrs.) K. Saradmoni, Senior Lecturer.

16. (11) Shri Kamalendu Bhattacharya, Section Officer.

Officers of the Institute (ex-officio) (0)

17. (1) Director

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Professor-in-Charge of Scientific Division (5)

18. (ii) Dr. Asok Maitra, Professor, Theoretical Statistics & Mathematics.
 19. (iii) Shri Debdas Chaudhuri, Applied Statistics, Surveys & Computing Division.
 20. (iv) Dr. Asok Rudra, Professor, Social Sciences Division (Dr. N. Bhattacharya, from 19 July 1979).
 21. (v) Dr. Ambarish Ghosh, Professor, Physical and Earth Sciences Division.
 22. (vi) Dr. Kanti Bhuvan Pakraai, Biological Sciences Division.
 23. (vii) Shri C. B. Prasad, Head of Statistics Quality Control and Operations Research Division.
 24. (viii) Dr. S. K. Mitra, Head, Delhi Centre (Dr. K. R. Parthasarathy from 6 November 1979).
 25. (ix) Dr. T. Krihnan, Dean of Studies.
- Shri N. Srinivasan, Officer-on-Special Duty, acted as non-member Secretary.

LIST OF MEMBERS OF DIFFERENT COMMITTEES

1. *Finance Committee of the Council :*

- (1) Director of the Indian Statistical Institute or his nominee (*ex-officio Chairman*).
- (2) Dr. P. K. Bose, Head, Department of Statistics, University of Calcutta.
- (3) Dr. Bhabatosh Dutta.
- (4) Dr. B. P. Adhikari.
- (5) Dr. J. Roy.
- (6) Shri S. M. Sundara Raju.
- (7) Dr. S. K. Mitra (Dr. K. R. Parthasarathy from 6 November 1979).
- (8) Dr. K. B. Pakraai.
- (9) Dr. Ambarish Ghosh.
- (10) & (11) Two representatives nominated by the Government of India (Dr. K. C. Seal, Director, C.S.O. and Sri N. K. Panda, Joint Secretary, Department of Expenditure, Ministry of Finance).
- (12) Shri P. K. Chatterjee, Senior Accounts Officer, Indian Statistical Institute (*non-Member Secretary*).

2. *Examinations Committee :*

1. Dr. P. K. Bose, Head, Department of Statistics, University of Calcutta; 2. Professor H. K. Nandi, Department of Statistics, University of Calcutta; 3. Professor A. M. Goon, Presidency College, Department of Statistics; 4. Professor T. V. Abhadhani, University of Andhra; 5. Dr. T. P. Abraham, Additional Director, C.S.O., Ministry of Planning, Government of India; 6. Dean of Studies, Indian Statistical Institute; 7. Dr. B. Ramachandran; 8. Dr. J. Roy; 9. Dr. K. R. Parthasarathy; 10. Shri Tarosh Maitra, *Secretary-Convenor*.

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3. *Journal Committee of the Institute :*

(i) *Committee for Sankhyā, Series A :*

1. Dr. R. B. Bahadur; 2. Dr. D. Basu; 3. Dr. V. S. Hazurbaraz; 4. Dr. R. K. Parthasarathy; 5. Dr. S. S. Srikhande and 6. Dr. Malay Ghosh.

Co-editors : 1. Dr. B. V. Rao and 2. Dr. K. R. Parthasarathy and 3. Dr. J. K. Ghosh.

(ii) *Committee for Sankhyā, Series B :*

1. Dr. T. V. Hazurav; 2. Dr. Sujit Kumar Mitra; 3. Dr. K. G. Ramamurthi; 4. Dr. J. Roy and 5. Dr. Malay Ghosh.

Co-editors : 1. Dr. J. C. Gupta and 2. Dr. Sujit Kumar Mitra and 3. Dr. J. K. Ghosh.

Advisers for Sankhyā, Series A and B :

1. Dr. R. R. Bahadur; 2. Dr. D. Basu; 3. Dr. V. S. Hazurbaraz; 4. Dr. S. S. Srikhande; 5. Dr. K. G. Ramamurthi; 6. Dr. J. Roy; and 7. Dr. J. Sotheraman.

(iii) *Committee for Sankhyā, Series C (Sample Surveys : Theory & Practice)*

Co-editors : 1. Dr. J. Roy and 2. Dr. Dozent J. Lanke (representing IASS).

Advisers : 1. Professor W. G. Cochran; 2. Dr. T. Dolenius (representing IASS); and 3. Dr. D. Basu; 4. Dr. A. Chowdhury; 5. Professor M. H. Hansen; 6. Dr. T. V. Hazurav; 7. Professor D. B. Lahiri; 8. Dr. M. N. Murti; 9. Professor Des Raj and 10. Dr. J. N. K. Rao.

(iv) *Committee for Sankhyā, Series D (Quantitative Economics) :*

1. Professor V. M. Dandekar; 2. Dr. L. Hurwits; 3. Dr. N. S. Iyengar; 4. Dr. B. S. Minhas; 5. Professor M. Mukherjee; 6. Dr. A. Rudra; 7. Dr. T. N. Srinivasan and 8. Dr. P. K. Bardhan.

Co-editors : 1. Professor A. L. Nagar and 2. Dr. N. Bhattacharyya.

Advisers : 1. Professor V. M. Dandekar; 2. Dr. L. Hurwits; 3. Dr. N. S. Iyengar; 4. Dr. B. S. Minhas; 5. Professor M. Mukherjee and 6. Dr. A. Rudra.

Joint editors for all the above series : 1. Dr. C. R. Rao and 2. Dr. G. Kallianpur.

4. *Technical Advisory Committees :*

I. *Theoretical Statistics and Mathematics Division*

1. Director of the Institute (*Chairman*); 2. Dr. M. S. Narasimham, School of Mathematics, Tata Institute of Fundamental Research, Bombay; 3. Dr. R. P. Pakshirajan, Professor and Head, Department of Post-Graduate Studies and Research in Statistics, University of Mysore; 4. Dr. G. Sankaranarayanan, Professor and Head, Department of Mathematics and Statistics, Annamalai University; 5. Dr. M. Sroehari, Professor, Department of Statistics, Faculty of Science, The Maharaja Sayajirao University of Baroda; 6. Dr. Asok Mitra, Professor-in-Charge (*Convener*).

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II. Applied Statistics, Surveys and Computing Division

1. Director of the Institute (*Chairman*); 2. Dr. H. K. Nandi, Professor, Department of Statistics, University of Calcutta; 3. Dr. P. V. Sukhatme, Honorary, Professor of Biometry, Department of Biometry, Maharashtra Association for Cultivation of Science; 4. Dr. K. C. Seal, Director, Central Statistical Organisation, Department of Statistics, Ministry of Planning; 5. Dr. P. B. Patnaik, United Nations Adviser (Retired); 6. Dr. K. R. Nair, Director, (Retired), C.S.O.; 7. Dr. Mohan Kaul, Indian Institute of Management, Calcutta; 8. Shri M. S. Gokhale, Head, Computer Centre, New Delhi; 9. Professor E. V. Krishnanurthy, Department of Applied Mathematics, Indian Institute of Science, Bangalore; 10. Dr. R. Sarkar, Professor of Computer Science, Indian Institute of Technology, Kanpur; 11. Dr. P. Roy, Director of Research, Council for Social Development, New Delhi; 12. Dr. S. K. Chatterjee, Reader in Statistics, Department of Statistics, University of Calcutta; 13. Professor M. Mukherjee, Director, Indian Council of Social Science Research, New Delhi; 14. Shri V. V. Divatia, Executive Director, Reserve Bank of India; 15. Shri D. Chaudhuri, Professor-in-Charge (*Convener*).

III. Social Sciences Division

1. Director of the Institute (*Chairman*); 2. Dr. A. R. Desai, Professor of Sociology, University of Bombay; 3. Professor Raj Krishna, Member, Planning Commission; 4. Dr. A. Mitra (ICS), Professor Jawaharlal Nehru University; 5. Dr. Shib Kumar Mitra, Director, National Council of Educational Research Training; 6. Professor Bhabatosh Dutta; 7. Professor Surajit Chandra Sinha, Vice-Chancellor, Vidyabharati University; 8. Shri S. J. Poti, Madras; 9. Dr. Ambika Ghosh, Dean, Faculty of Arts, University College of Arts, Jadavpur University; 10. Professor D. B. Lahiri; 11. Dr. Barun Kumar De, Director, Centre for Studies in Social Sciences, Calcutta; 12. Professor Yogendra Singh, Department of Sociology, Jawaharlal Nehru University, New Delhi; 13. Dr. A. Edwin Harper (Jr.), Bureau of Educational Research, Allahabad; 14. Dr. Bivranath Mukherjee, Director of Research, Council for Social Development, New Delhi, and 15. Professor-in-charge, Social Sciences (*Convener*).

IV. Physical and Earth Sciences Division

1. Director of the Institute (*Chairman*); 2. Dr. K. R. Surange, Director, Birbal Sahani Institute of Palaeobotany, Lucknow, U.P.; 3. Professor Bivaranjan Nag, Jawaharlal Nehru Fellow, Institute of Radio Physics, University College of Science, Calcutta; 4. Professor B. B. Roy, Department of Agricultural Chemistry, Calcutta University, Calcutta; 5. Professor (Mrs.) Ashima Chatterjee, Khaira Professor of Chemistry, Department of Chemistry, Calcutta University, Calcutta; 6. Professor B. S. Ramakrishna, Chairman, Electrical Science, Department of Electrical Communication Engineering, Indian Institute of Science, Bangalore; 7. Professor J. Das, Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur; 8. Professor M. Datta, Department of Applied Mathematics, University of Calcutta; 9. Professor Saurindranath Sen, Department of Geography, University of Calcutta, Calcutta; 10. Professor A. K. Saha, Department of Geology, Presidency College, Calcutta; 11. Professor B. S. Tewari, Director and Professor, Department of Geology, Punjab University, Chandigarh; 12. Professor H. N. Mahabala, Indian Institute of Technology, Madras; 13. Dr. Ambarish Ghosh, Professor-in-Charge (*Convener*).

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V. *Biological Sciences Division*

1. Director of the Institute (*Chairman*); 2. Professor A. K. Sharma, Professor and Head, Department of Botany, University of Calcutta; 3. Dr. L. D. Sanghvi, Dean, Cancer Research Institute, Tata Memorial Centre, Bombay; 4. Dr. J. J. Ghosh, Centenary Professor and Head, Department of Biochemistry, University of Calcutta; 5. Dr. Sivatoth Mukherjee, Dean, School of Life Science, Jawaharlal Nehru University, New Delhi; 6. Professor P. N. Bhaduri, Scientist (ICAR), Bidhan Chandra Kriahi Viswa Vidyalaya, West Bengal; 7. Professor B. B. Biswas, Head of the Department of Biochemistry, Bose Institute, Calcutta; 8. Professor Inder P. Singh, Professor and Head, Department of Anthropology, Delhi University; 9. Dr. Arvind J. Baxi, Assistant Director, Haffkine Institute (Blood Group Reference Centre), Bombay; 10. Dr. Narendra Singh, Scientist, Eprotein Technology, Discipline, Central Food Technological Research Institute, Mysore; 11. Shri H. K. Rakshit, Director, Anthropological Survey of India, Government of India, Indian Museum, Calcutta; 12. Dr. K. B. Pakrasi, Professor-in-Charge (*Convener*).

VI. *Statistical Quality Control and Operations Research Division*

1. Director of the Institute (*Chairman*); 2. Dr. H. Bhaya, Director, Indian Institute of Management, Calcutta; 3. Shri P. N. Arumugham, Chief, Quality Assurance, Bharat Hoery Electricals Ltd., New Delhi; 4. Dr. A. K. Gupta, Director-General, Indian Standards Institute, New Delhi; 5. Dr. B. P. Banerjee, Director, Balmer Lawrie & Co. Ltd., Calcutta; 6. Mr. M. V. Vonkataraman, Regional Director, National Productivity Council, Madras; 7. Dr. G. V. S. Desikan, Chairman, Kerala State Textile Corpn. Ltd., Trivandrum; 8. Dr. P. L. Agrawal, Chairman, Steel Authority of India Ltd., New Delhi; 9. Dr. D. V. Kapur, Chairman and Managing Director, National Thermal Power Corporation Ltd., New Delhi; 10. Shri C. R. Prasad, Head, SQO & OR Division (*Convener*).

VII. *Library, Documentation and Information Science Division*

1. Director of the Institute (*Chairman*); 2. Shri H. D. Sharma, University Librarian, Banaras Hindu University, Library; 3. Dr. A. K. Ohdecer, Chief Librarian, Jadavpur University Library; 4. Dr. V. A. Kamath, Head, Library & Information Sciences, Bhabha Atomic Research Centre, Trombay; 5. Professor K. S. Dalal, Librarian, Kurukshetra University Library, Haryana; 6. Shri V. N. Misra, Librarian, Indian Institute of Technology, Bombay; 7. Dr. J. Mishra, Chief Librarian, I.S.I. (*Convener*).

5(a) *Works Advisory Committees for construction, Baranagar, Calcutta*

1. Dr. P. K. Bose (*Chairman*); 2. Shri S. Bandopadhyay; 3. Shri P. K. Mitra (outside Expert); 4. Dr. J. Roy; 5. Dr. D. K. Bose; 6. Dr. J. Misra; 7. Shri V. S. Bhat; 8. Shri Supriya Gupta; 9. Shri Somen Chakravarti; 10. Shri Sanjay Sinha; 11. Shri Binay Bose (*Convener*).

5(b) *Works Advisory Committee for construction, Delhi*

1. Dr. Jagjit Singh (*Chairman*); 2. Shri R. S. Panesar (Co-opted member); 3. Dr. Sujit Kumar Mitra; 4. Shri B. K. Sarkar; 5. Dr. V. K. Chetty; 6. Professor B. L. S. Prakash Rao; 7. Professor K. R. Parthasarathy; 8. Shri R. K. Sawhney (*Member-Convener*).

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6(a) *Joint Consultative Committee for non-scientific workers*

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The Academic Council consists of :

- All Professors, Research Professors and Distinguished Scientists.
- Two representatives of each of the six Divisions.

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(ii) Applied Statistics, Surveys and Computing Division :	1. Dr. Sukharanjan Chakravarti 2. Dr. Sunil Krishna Paul
(iii) Social Sciences Division :	1. Dr. Sanjit Bose 2. Shri Kumarananda Chattopadhyay
(iv) Physical and Earth Science Division :	1. Shri Amulya Bhusan Gupta 2. Shri Dhiraj Kumar Rudra
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INDIAN STATISTICAL INSTITUTE

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