

# INDIAN STATISTICAL INSTITUTE



## FIFTYFIRST ANNUAL REPORT

April 1982—March 1983

203, BARRACKPORE TRUNK ROAD  
CALCUTTA-700 036

# INDIAN STATISTICAL INSTITUTE

## FIFTY-FIRST ANNUAL REPORT

April 1982—March 1983

### CONTENTS

Page

#### PART I : Teaching, Training, Research, Projects and Publications

1. Teaching and Training ... ..	1
1.1 Degree and Training Courses ... ..	1
1.2 International Statistical Education Centre (ISEC) Calcutta ... ..	3
1.3 Professional Examinations in Statistics ... ..	4
2. Research Work ... ..	5
2.1 Theoretical Statistics and Mathematics ... ..	5
2.2 Applied Statistics, Surveys and Computing ... ..	6
2.3 Physical and Earth Sciences ... ..	7
2.3.1 Chemistry ... ..	7
2.3.2 Electronics ... ..	7
2.3.3 Electronics and Communication Sciences ... ..	9
2.3.4 Geology ... ..	11
2.3.5 Physics ... ..	11
2.3.6 Flume Project ... ..	11
2.4 Biological Sciences ... ..	12
2.4.1 Anthropometry and Human Genetics ... ..	12
2.4.2 Biochemistry ... ..	12
2.4.3 Botany ... ..	13
2.4.4 Crop Science ... ..	14
2.4.5 Embryology ... ..	15
2.4.6 Entomology ... ..	15
2.4.7 Leaf Protein ... ..	15
2.5 Social Sciences ... ..	16
2.5.1 Demography ... ..	16
2.5.2 Economics, Econometrics and Planning ... ..	17
2.5.3 National Income Research ... ..	18
2.5.4 Linguistic Research ... ..	19
2.5.5 Pre-Census Population Studies ... ..	20
2.5.6 Psychometry ... ..	21
2.5.7 Sociology ... ..	21
2.6 Statistical Quality Control and Operation Research ... ..	23
2.7 Library, Documentation and Information Sciences ... ..	24
3. Conferences, Seminars and Symposia ... ..	27
4. Publications ... ..	28
5. List of Scientific Papers and Publications ... ..	29
5.1 Scientific Papers Published ... ..	29
5.2 Papers submitted accepted for Publication ... ..	44

5.3	Papers read at conferences	...	...	...	...	53
5.4	Books Published	...	...	...	...	64
5.5	Articles published in books	...	...	...	...	65
5.6	Technical Reports	...	...	...	...	68
<b>PART II : Convocation, Visiting Scientists, Honours and Awards, Scientific</b>						
	Tours and Assignment	...	...	...	...	72
6.	Convocation	...	...	...	...	72
7.	Visiting Scientists	...	...	...	...	76
8.	Honours, Awards and Special Assignments	...	...	...	...	80
9.	Scientific Tours and Assignments Abroad	...	...	...	...	83
10.	Scientific Assignments in India	...	...	...	...	85
11.	Eighty-ninth Birth anniversary of Late Professor P. C. Mahalanobis	...	...	...	...	89
12.	Delhi Centre	...	...	...	...	89
<b>PART III : Administration and Office bearers</b>						
	Administration and Office bearers	...	...	...	...	93
13.	General Administration	...	...	...	...	93
14.	List of President, Chairman and Members of the Council, Members of the Committees of the Council and Academic Council	...	...	...	...	96
<b>PART IV : Statement of Accounts and Auditor's Report for the year 1982-83</b>						
	Statement of Accounts and Auditor's Report for the year 1982-83	...	...	...	...	105

# INDIAN STATISTICAL INSTITUTE

## FIFTY-FIRST ANNUAL REPORT

April 1982—March 1983

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

#### I. TEACHING AND TRAINING

##### 1.1 Degree and Training Courses

During the period under review, 5742 candidates applied for admission and were called for written selection tests for the courses offered by the Institute viz. B. Stat. (Hons.), M. Stat., M. Tech., one year Post-Graduate Diploma in SQC and OR, two-year part-time Post-Graduate Diplomas in SQC and OR (Bombay and Madras), Research Fellowships in Statistics, Mathematics and Economics, one-year evening course in Statistical Methods and Applications and the course on Operation of Data Processing Equipment. Admission tests were conducted at 12 centres all over the country and successful candidates were called for interview for final selection for admission to various courses during the academic year 1982-83.

1.1.2 There were six foreign applicants who had either been sponsored by the Government or applied directly for admission to our courses. The candidates were given special admission tests conducted through the Indian High Commission or Embassies at Bangladesh, Malaysia, Ghana and Kenya.

1.1.3 The annual examinations of B. Stat. and M. Stat. courses were held in May/June 1982. The 1982-83 academic year commenced on 12 July 1982.

1.1.4 One hundred and six candidates received their degrees and diplomas at the Seventeenth Convocation of the Institute held on 28 February 1983. Further 156 candidates, who passed various regular courses of duration one year or less received certificates during the period.

1.1.5 The numbers of candidates admitted to the different degree, diploma and training courses during 1981-82 and 1982-83 and the results of examinations held during the period are given below.

Courses	Number of students Number passed in		
	1981-82	1982-83	Annual Examination 1982
1. Courses leading to a Degree in Statistics			
1.1 Bachelor of Statistics with Honours—			
B. Stat. (Hons.)			
1st year	28	23	20
2nd year	11	20	11
3rd year	21	11	21

INDIAN STATISTICAL INSTITUTE

<i>Courses</i>	<i>Number of students</i>		<i>Number passed in Annual Examination 1982</i>
	1981-82	1982-83	
1.2 Master of Statistics (M. Stat)			
1st year	27	41	26
2nd year	30	25	28
1.3 Junior and Senior Research Fellows, Visiting Fellows	85	90	No formal exam.
2. <i>Specialised Courses in Applied Statistics leading to Diplomas :</i>			
2.1 Statistical Quality Control and Operations Research (One year)	20	15	16
3. <i>Courses in Statistics for persons in Employment (jointly with C.S.O.) :</i>			
3.1 Junior Certificate Course in Statistics	19	13	13
3.2 Indian Statistical Service Probationers' Training Course	37	38	38
4. <i>Evening Course</i>			
4.1 Statistical Methods and Applications			
Calcutta	43	44	16
Delhi	9	not held	3
4.2 Two-year Post-Graduate Diploma in Statistical Quality Control and Opera- tions Research (Bombay & Madras)			
Bombay — 1st year	7	3	3
2nd year	3	3	2
Madras — 1st year	19	14	11
2nd year	12	11	8
4.3 Six-month Evening Course in Statistical Quality Control (Bangalore & Hyderabad)			
Bangalore — January-June Batch	29	27	8
July-December „	30	20	10
Hyderabad — July-December „	13	27	9
January-June „	20	31	16

FIFTYFIRST ANNUAL REPORT : 1982-83

Courses	Number of students		Number passed in Annual Examination 1982
	1981-82	1982-83	
5. <i>Electronic Computer Courses</i>			
5.1 M. Tech. in Computer Science (course started from 1981-82)			
1st year	11	22	9
2nd year	—	8	—
5.2 Two-year Advanced Diploma in Computer Science (course discontinued from 1981-82)			
1st year	—	—	—
2nd year	9	—	7
5.3 Intensive Course on Programming and Applications			
	37	39	33
5.4 Course on Operations of Automatic Data Processing Equipment			
	11	14	10
6. <i>Associateship in Documentation and Information Science</i>			
	10	8	not available
	541	547	318

1.2 *International Statistical Education Centre (ISEC), Calcutta*

The ISEC, started in 1950, 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); *Secretary*, Department of Statistics, Government of India (representing the Government of India) and B. P. Adhikari and N. Bhattacharya (Member-Secretary) representing the Indian Statistical Institute).

During the year, the Centre conducted the Regular Course of the 36th term with 25 trainees from 12 countries in South and South-East Asia, the Far East and Commonwealth Africa. The Government of India awarded 14 fellowships for the foreign trainees

## INDIAN STATISTICAL INSTITUTE

—5 under the TCS of the Colombo Plan and 9 under Special Commonwealth African Assistance Plan (SCAAP). Three foreign trainees were awarded CPTC fellowships. Four Indian trainees and four from Sri Lanka were financially supported by their respective governments. The 10-months Regular Course started on 1 June 1982. From June to September the trainees stayed at Calcutta and studied theory and applications of statistics, besides mathematics and economics. Most of the courses taught at this stage were compulsory for all trainees. During October-November, they attended a six-week programme of training in Official Statistical Systems and Procedures at New Delhi and other places. This part of the Regular Course was conducted by the CSO, Government of India. General training in Statistics was resumed at Calcutta around the middle of November and was completed by the end of January 1983. Most of the courses taught in this phase were optional and each trainee studied four or more courses chosen by him. Thereafter, the trainees entered the last phase of their training programme and each of them specialized in one area selected by him, e.g., sample surveys and data processing, economic planning, demography and vital statistics, and SQC & OR. Examinations were conducted for each of the four phases of the training programme indicated above. The certificate-awarding ceremony was held on 29 March 1983 and all the 25 trainees were awarded Certificates of Merit in recognition of their satisfactory performance in the examinations.

In addition to the above, three trainees attended Special Courses during the period under review. Two of them had completed the Regular Course of the preceding term on 31 March 1982. One from Tanzania attended a three-month Special Course in Statistics of Prices, Employment and Earnings during April-June 1982, with the support of a SCAAP fellowship awarded by the Government of India, and the other from Sri Lanka underwent a three-month Special Course in 'Economic Development and Planning' during the same period, and she was supported by a Government of India fellowship under the Colombo Plan. Finally, one UNDP fellow from Afghanistan joined a one-year Special Course in 'Sampling and Demography' in August 1982.

### 1.3 Professional Examinations in Statistics

The holding of professional examinations in statistics for external candidates on an all-India basis has been an important activity of the Institute since 1938. These examinations are based on well organised syllabi to reach high professional standards and lead to Certificates and Diplomas.

During the year under report, the Statistical Assistantship Certificate, Junior Diploma in Statistics and Senior Diploma in Statistics examinations were held at Bangalore, Bombay, Calcutta, Delhi, Hyderabad, Lucknow and Madras centres during April and October 1982 terms.

The number of candidates who registered, appeared and passed during the terms are shown below.

FIFTYFIRST ANNUAL REPORT : 1982-83

Examination	Number of candidates					
	Registered		Appeared		Passed*	
	April	October	April	October	April	October
Statistical Assistantship						
Certificate	25	34	13	22	5	10
Junior Diploma in						
Statistics	25	23	15	8	none	2
Senior Diploma in						
Statistics	11	15	8	12	2	5

\* In one or more papers only, not necessarily completed the examination.

The total number of candidates who have qualified for the award of Certificates and Diplomas in these professional examinations in statistics including the results of October 1982 term are 468 and 233 respectively.

## 2. RESEARCH WORK

A brief account of the progress of research in different divisions and units of the Institute is given below.

### 2.1 THEORETICAL STATISTICS AND MATHEMATICS

#### 2.1.1 Calcutta

The list of published papers and technical reports give a detailed idea of the work done in this Division in various disciplines of mathematics and statistics. During the period, members of the Division have been engaged in research in the following areas : Stochastic Processes, Probability Theory, Probabilistic Number Theory, Asymptotic Theory, Multivariate Analysis, Decision Theory, Inference about Stochastic Processes, Sampling Theory, Design of Experiments, Combinatorial Mathematics and Graph Theory, Descriptive Set Theory and Mathematical Logic, Measure Theory, Harmonic Analysis, Functional Analysis, Algebraic Topology, General Topology, Topological Automata, Sediment Transport.

Among its other activities, the Division held a Summer School in Recent Developments in Statistical Methodology in Dharwar, Karnataka from 9 May to 24 May 1983.

#### 2.1.2 Delhi

Studies were carried out in the following fields : Mathematical Theory of Scattering, Stochastic Integrals and their applications to Quantum Mechanics, Rational Homotopy Theory and related topics in Differential Geometry, Algebraic and different Differential



## INDIAN STATISTICAL INSTITUTE

Topology, Quantum Mechanics and Stochastic Processes, Operational Research in Games Theory, Optimal Designs combining independent estimates, Linear Models and Shorted Operators.

### 2.1.3 Bangalore

Recent applications of ergodic theory to information theory and coding theory are under study. Asymptotic problems in coding theory are studied in relation to similar problems in topological entropy theory. Another topic under study is the relationship between testing of statistical hypotheses and certain results in Source Coding Theory.

## 2.2 APPLIED STATISTICS SURVEYS AND COMPUTING

2.2.1 Research activities in the Division include both theoretical investigation of methodology and applications of the existing methods to the solution of practical real life problems which has social relevance. During the year 1982-83 research was conducted in the following broad areas :

(i) *Applied Statistics* : Topics in design of experiments, combinatorics, multivariate analysis and psychometrics are covered. The principal areas of research in the design of experiments and combinatorics are orthogonal arrays, optimality consideration of block designs under mixed effects model, robustness of designs and characterisation problems in graphs. Optimality and robustness properties of estimation and testing procedures are under study in the context of the general linear model set up. Research is also carried out in the area of multivariate analysis, growth curve models, analysis of covariance structures and analysis of qualitative data.

(ii) *Survey methodology* : Areas covered are randomised response techniques, optimal sampling strategies and use of unbiased product-type estimators.

(iii) *Computing* : The main research activities in the area of computer science are in the field of Data Base Management and Fault Tolerant Computing. Work is continuing on the development of 'A Programme Package for Analysis and Management of Statistical Data', which involves the development of a data base management system. This system allows the users to define data structure similar to that used in survey data, editing of data in this data base creating tables of different types. The language design was completed in 1979-80. The overall theoretical design of the system was completed last year. Preliminary work on implementation of the different phases of the projects was completed during 1982.

Studies on consecutive retrieval property in files, integrity in data bases and prevention of deadlocks are under close attention. Two custom-tailored data base management systems for survey data and time series data are under development. The emphasis in fault tolerant computing is on the design of self diagnosable systems under different constraints. In addition, tools for diagnosis of sequential and combinatorial circuits are also being investigated.

## FIFTYFIRST ANNUAL REPORT : 1982-83

(iv) A study on Immunological Profiles of Malaria Infested Area in Ajodhya Hills and Jhanda of Purulia district had been conducted in 1981-82 and the project was terminated on 31 March 1982. Analysis of data collected was in progress.

2.2.2. *Projects and surveys undertaken during the year are as follows :* (a) Survey of foreign tourists in India, 1982-83 (sponsored by the Ministry of Tourism and Civil Aviation) : The basic objectives of this study are to collect and interpret all information necessary for promotion of tourism in India. On the basis of this sample survey, an attempt will be made (1) to study the socio-economic and demographic profiles of foreign tourists, (2) to make an analysis of their expenditure patterns during their stay in India, (3) to study their preferences with respect to mode of internal travel, choice of accommodation and other aspects of living, (4) to analyse difficulties, if any, during their stay in India and (5) to assimilate their suggestions for improving the tourist services. Field work for this survey started on 2 April 1982 and continued till 3 March 1983.

(b) *Survey of farmers (sponsored by ILO) :* The survey was completed in December 1982. The monograph entitled "Expansion of Employment Through Local Resources Mobilisation" has been published by the Asian Regional Team for Employment Promotion (ARTEP) of the ILO.

(c) *Development of a selection test for the recruitment of statistical officers :* Members of the Division participated in Expert Committees for acceleration of data processing for the National Sample Survey Organisation.

## 2.3 PHYSICAL AND EARTH SCIENCES

### 2.3.1 Chemistry

*Study of soil humus :* Investigation on the distribution and composition of humus substances in soils of West Bengal has been continued during the period. Electrometric, electrokinetic and spectrophotometric studies of the humic acid, fulvic acid and humin constituents of humus were undertaken. Dissociation constants of humic acid were calculated fitting potentiometric data to modified Hasselbach-Henderson equation. The values thus obtained were shown to bear correlation with natural hydro-thermal condition under which individual humus substances are developed.

Absorptive interactions of soil constituents : Absorption behaviour of humic acid samples towards micronutrients, e.g. copper and zinc, antibiotics, e.g. tetracycline and surface-active reagents have been studied. The work is being continued.

### 2.3.2 ELECTRONICS

#### 2.3.2.1 Digital Electronics

(1) *Development of Microcomputer systems :* This is an on-going project. A general purpose Microcomputer has been developed around Motorola 6800 Micro-

## INDIAN STATISTICAL INSTITUTE

processor, chip. The system is being updated by a 6809 chip which has hardware multiplier, dynamic address translation facilities and more powerful instruction sets.

A 16 bit microcomputer using Intel's 8086 microcomputer has also been developed.

(2) *Design and development of a dedicated signal processing system using F.F.T. :* This is an on-going project. A microprocessor based on-line F.F.T. processor has already been developed around the existing M6800 processor. Work is in progress to reduce the total FFT computation time using the updated version of M6800 system with M6809 chip.

(3) *Development of microprocessor based special purpose system :* With the availability of general purpose system in the laboratory, several microprocessor based special purpose system have been developed. They are (a) Microprocessor based line voltage monitoring system, (b) Microprocessor based line frequency monitoring system, (c) Microprocessor based PROM programmer, and (d) Microprocessor based off-line paper tape preparation unit.

(4) *Data Acquisition System :* A 6800 microcomputer based data acquisition system is being developed which will be able to monitor eight analog variables, convert them to digital form, process the information and then take on-line action if necessary. A high speed analog multiplexer and a 12 bit A/D converter has been connected with the 6800 microcomputer for acquisition of analog information.

(5) *Development of software packages :* A simple CAI packages "Tutor" which allows the new user to interactively learn about the motorola 6800 microcomputer has been implemented on the M6800 system itself. A process scheduler module which will ultimately convert the M6800 microcomputer into a multiuser system, has been developed. Further software development along this line is under way.

(6) *Theoretical research on computer science :* Theoretical works are being carried out on area of (a) Fault Tolerant Computing, (b) Microprogramming, (c) Computer Architecture, (d) Logic Design and (e) Graph Theory and combinatorics. Several useful results have been obtained in these areas.

### 2.3.2.2 Theoretical Physics

Studies relating to the geometrical aspects of super-symmetry, internal symmetry of hadrons and grand unification have been pursued. Some problems related to multi-particle production phenomena have been investigated. High energy heavy ion reaction has also been investigated on the basis of results obtained in multiparticle production analysis. The dynamical deviation of Baryon-Baryon potential has also been achieved. The quantum measurement with special reference to stochastic spacetime has been investigated.

Using operator techniques eigen values for anharmonic oscillators of the type have been studied thoroughly. In plasma physics explosive instabilities have been

investigated in case of four and five wave interactions. Also a modified K.B.M. perturbation technique has been applied to nonuniform plasma problems.

### 2.3.2.3 Fluid Mechanics

(i) Trajectories of particles of different size and density in a hydrocyclone separator was studied theoretically. The distribution of particles obtained in this way will be used to solve the two-phase boundary layer flow in the hydrocyclone.

(ii) The cold flow problem for opposed jet used for flame stabilization was studied. The stability of the vortices in a two-dimension flow was analysed. The results obtained will be used to trace the streamlines for a flow with solid body vortices and compared with experimental results.

(iii) A work has been undertaken to simulate human finger prints with the help of different distributions of vortices, sources and sinks and a steady flow. This has been taken up with a view to minimize the number of parameters in identifying different types of finger prints.

(iv) Non-linear stability analysis has been studied for two different problems viz. asymptotic suction profile in the presence of uniform magnetic field and Ekman boundary layer on a porous plate in the presence of suction and injection. Stability of the spiral poiseuille flow will be studied by using the bifurcation theory.

(v) To study theoretically the response of sea surface on an inclined continental bed due to a storm generated in the deep sea.

(vi) To develop numerical models of tidal estuaries a joint research scheme between ISI and Calcutta Port Trust has been taken up.

### 2.3.3 ELECTRONICS AND COMMUNICATION SCIENCES

(i) *Theoretical and experimental investigation of Pattern Recognition and Artificial Intelligence techniques* : Various types of Statistical, Syntactic and Fuzzy set theoretic algorithm for machine recognition of diverse patterns mainly of biological origin such as hand written character ECG, finger print, etc. have been developed.

(a) *Symmetry analysis by computer* : Some work in connection with the symmetry analysis for both open and closed curve and figure have been developed and already been published in the leading international journals.

(b) *Syntactic Pattern Recognition* : Some work on the recognition of hand written connected numerals using syntactic technique have been completed and the result had been published.

(c) *Statistical pattern recognition* : Some important works on estimation of Bayes error probability for noisy and imprecise measurement have been done. These works have already been published in the internal journals.

## INDIAN STATISTICAL INSTITUTE

(d) *Fuzzy set theoretic approach for pattern recognition* : A good amount of work on pattern recognition using fuzzy set theoretic approach has already been completed and reported in various technical journals. A new approach to the estimation of fuzzy membership function has been developed.

(ii) *Theoretical and experimental investigation of the methodologies for image analysis and image understanding system* :

(a) *Image analysis and Image data compression* : Some useful shape analysis algorithms for two tone images have been developed and the results had already been published in technical journals. The works on image data compressing is going on. Some has already been communicated for publication.

(b) *Image restoration, enhancement and edge detection* : Some preprocessing algorithms for image restoration, enhancement and edge detection have been developed. Some of these results have already been published and others have been communicated. The work on image understanding system is in progress.

(iii) *Studies on automatic speech recognition and speech processing* : Works on phoneme structure of some Indian language and their application in ASR are under investigation. Linear prediction coefficient (L.P.C.) analysis has been applied and the results have been reported to the different conferences. Syntactic approach in ASR is under investigation.

(iv) *Theoretical and experimental investigation on digital communication and data compression* : Data compression with a class of linear map has already been developed and also published in the related international journal. A microprocessor based communication model is being developed.

(v) *Research in biomedical signal processing for diagnostics and development of a patient monitoring system* : Characteristics of biomedical signals have been studied and results reported. The nature of the biomedical signals under different condition is under investigation. A project sponsored by the Electronics Commission, Government of India is now at the completion stage. The system under development meant for noise free display of E.C.G. signal and can be used for rural areas. A fuzzy approach for medical diagnostics have also been undertaken.

(vi) *Studies on Cybernetics and System Theory* : Several studies in this field such as Generalised Fuzzy Set Theoretic Approach for biological systems, application of possibility theory in Man-Machine system are in continuation and results obtained at various stages have been reported. Some works on power systems modelling using fuzzy approach have been undertaken. A work on fuzzy linguistic approach for the decoupling of a large multivariate system in the reference of power plant operation has been done, and the results have been already communicated.

### 2.3.4 GEOLOGY

(i) *Programme of geological research in the Pranbha-Godavari Valley* : Progress was made in the following areas :—

Structural analysis of the Proterozoic rocks of Andhra Pradesh (Pakhal) and central Rajasthan (Delhi); stratigraphy and sedimentation of Precambrian rocks; stratigraphy and sedimentology of the Albaka sequence and its comparison with the Pakhal sequence; origin of marine arkose sedimentation; geology of the Gondwana of the northern part of the Pranbha-Godavari Valley, Gondwana stratigraphy of the Manbani doab and adjoining areas, carbonate units in the late Triassic Maleri Formations stratigraphy of the Upper Gondwana sequence with special reference to sedimentology of Jurassic rocks; studies on trace fossils from Yerrapalli, Maleri and Kola Formation; study of Triassic dicynodonts; discovery of new vertebrates from the triassic beds; study of a giant amphibian from the Triassic beds; review of the genus *Lepidotes*, with special reference to the species from Kola Formation; Inter-trappean micro-vertebrates and their palaeo-geographic implications; some upper Cretaceous vertebrates from India.

### 2.3.5 PHYSICS

(i) *Studies on the mechanical properties of human tissues and organs* : It is an on-going project. Creep, stress-relaxation and hysteresis studies of human skin samples under uniaxial loading, the correlation of the tensile breaking load of human umbilical cord with the weight of the baby at birth, the bursting strength of hydrocele and hernial sacs and the hardness of human finger nail for both normal and pathological specimens deserve particular mention. The results of the studies so far obtained have been reported.

(ii) *Study on the methods and applications of the control theory to electrical machines and power systems* : The study was taken up during the year.

### 2.3.6 FLUME PROJECT

Data obtained from flume experiments on size distributions of sediments deposited from suspension have been analysed and interpreted. Flume experiments show that some fractions of all grain sizes in suspension deposit simultaneously when the flow velocity is decreased. A mathematical model is established for calculation of pattern of deposition for different grain sizes.

Experiments are also being conducted to study (i) the effect of sand bed roughness on the size distribution in suspension, and (ii) the weight frequencies of different grain sizes in suspension while we add successively the amount of material of different sizes in the flume in such a manner that the initial bed roughness should be same.

## INDIAN STATISTICAL INSTITUTE

### 2.4 BIOLOGICAL SCIENCES

#### 2.4.1 Anthropometry and Human Genetics

(i) *Impact of altitude on human populations* : Demographic and anthropometric data were being collected on the Lepchas of Kalimpong subdivision.

(ii) *Study on the relationship between socio-economic condition, nutrition and health* : Collection of data continues.

(iii) *Remedial study on Portuguese decendtry of Mirpur Village, Midnapore district, West Bengal* : Demographic and anthropometric data collected in two villages shows microlevel differences among as well as within communities in demographic traits.

(iv) *Micro-evolutionary dynamics among the Mehars of Maharashtra* : Analysis of data so far led to certain salient findings. The data are being further analysed.

(v) *Genetic survey of some endogamous groups of Eastern India with special reference to Gm. Inv. Gc. and the markers systems* : (a) Iso-electric focussing technique for servicing of red cell isozymes and serum proteins was introduced for a number of systems. The data collected have led to certain findings on analysis. (b) Indo-Soviet collaborative anthropogenetic survey of 16 endogamous groups of Karnataka, Kerala, Tamil Nadu and Andhra Pradesh was conducted and about 1600 blood samples collected are under analysis.

(vi) *Study of physical growth of Bengali boys* : Data are under collection.

(vii) *Pattern of fertility and reproductive wastages by parity and social class* : Study of data collected was completed.

(viii) *Bioanthropological study of migrant African group, the Siddhis of India* : Analysis of data is in progress.

(ix) *Bioanthropological studies among Nandiwalas and Dhangers* : Analysis of data is in progress.

#### 2.4.2 BIOCHEMISTRY

(i) *Plant inorganic pyrophosphates* : Different methods of one step purification of *A. blitum* L. inorganic pyrophosphates have been investigated. These include the affinity chromatographic separation of the enzymeprotein through pyrophosphate linked hexamethylene diamine Sepharose matrix and chromatofocusing technique using poly buffer ion exchanger and suitable pH gradient producing resin. The enzyme has also been purified by disc electrophoresis technique.

## FIFTYFIRST ANNUAL REPORT : 1982-83

(ii) *Correlation of Cyanomethaemoglobin and Oxyhaemoglobin levels in adult human beings* : To examine if any relationship exists between the technically complicated measurement of cyanomethaemoglobin and the simpler oxyhaemoglobin (and other haematological parameters), about 300 blood samples collected by finger pricking were examined in the field for oxyhaemoglobin and haematocrit value samples collected for cyanomethaemoglobin have been brought in the laboratory and estimated for cyanomethaemoglobin (spectrophotometrically). The above blood samples were also examined for differential leucocyte count and total serum protein as a part of another project (in collaboration with AIGU) to examine the nutritional status of the population. Further, the samples are in the process of screening electrophoretically for abnormal haemoglobins.

(iii) *A study on dietary intake pattern body measurement parasitic load and other health indicators among the inmates of two old-age homes in Calcutta city (in collaboration with AIGU)* : The object of the study was to evaluate the health status of Calcutta elderly populations and the effect of socio-cultural factors on the same. Analysis of dietary intake data in one old age home shows that the dietary intakes of this sedentary group are not deficient by I.C.M.R. recommendations.

(iv) *Impact of altitude on human population (in collaboration with AIGU)* : 205 blood samples collected from the Lepcha population in Nimbung area of Kalimpong sub-division in North Bengal by finger pricking were examined for oxyhaemoglobin, haematocrit values, total serum protein and differential leucocyte count in the field laboratory itself and portions brought to the laboratory in Calcutta for screening them electrophoretically for abnormal haemoglobins. The 205 samples collected for cyanomethaemoglobin were also brought and estimated spectrophotometrically.

(v) *Distribution of intestinal parasites in West Bengal (in collaboration with AIGU)* : Analysis of 382 faeces samples examined earlier of a Mahishya population in a village in Howrah district was done to investigate whether differential prevalences in the intestinal parasitic infestation occurred in relation to the micro-cultural differences among the three economic sub-groups of the said population. The results show that such inter-economic sub-group differences do exist, particularly, among the children samples. Statistical design of the wider all-West Bengal, based on preliminary studies and available informations is under preparation.

### 2.4.3 BOTANY

(i) *Crop Improvement* : The rice breeding programme undertaken previously for evolving high-yielding rice varieties from indigenous germ plasma was continued. Two indigenous rice varieties selected for improvement are contemplated to be put for field trials during 1983-84 for comparison of performance with that of eight modern dwarf high yielding rice varieties. The performance trial of one improved indigenous rice variety 'Subarna' evolved by the unit previously was put to field trials at ISI experimental farm at Girdih, Bihar. The average grain, straw and biological yields



## INDIAN STATISTICAL INSTITUTE

(quintal/hectare) were 35.1, 97.0 and 132.1 respectively. Further, multilocational field trials are contemplated during 1983-84 with this variety in different agroclimatic conditions to determine its adaptive behaviour. This variety was also put to performance trial on the farmers' fields in different locations (Panskura Blocks I and II, Ghatal and Daspur Blocks and in eleven villages adopted by Arabari Social Forest) of Midnapur district. Because of severe draughts in West Bengal in 1982 which caused agricultural catastrophe, most of the trials on the farmers' fields failed to generate performance data of 'Subarna' rice variety. However, only a few farmers having access to artificial irrigation reported highly satisfactory performance of this variety.

(ii) *Intra-specific and inter-specific interactions in crop plants* : This Programme of study undertaken with an aim at generating a dependable data base on the relative performances of varietal and species mixtures to those in monoculture to establish their biological validity, performance stability and economic returns was continued. Eleven varietal mixture of rice, eleven mixed cropping systems with cereal/pulse combinations and one cereal/cereal mixture were studied during 1982-83. The results indicate that component-specific and mixture-type dependent neighbour effects occur. Some show cooperative interaction offering scope for agricultural exploitation for augmenting per unit of cropped production area.

(iii) *Behaviour and ecology of field rodent* : In continuation of previous study several paddy fields in ISI experimental farm were excavated for retrieval of hoarded paddy ear-heads to determine pre-harvest loss of winter rice due to rodent. Other behavioural studies are in progress.

(iv) *Deforestation : nature, cause and consequences* : Collection of preliminary data on species composition of Arabari Forest (Midnapore district, West Bengal) is in progress and collection of data on mushroom consumption behaviour of the population of the eleven adopted villages and use of construction inputs of thatched roofs of houses along with other socio-economic parameters of the population through a household survey has been completed.

### 2.4.4 CROP SCIENCE

(i) *General problems on levo- and dextro-rotatory situations present in different plant structures* : Alternate phyllotaxy usually leads to spiral arrangements of leaves in a palm crown and accordingly the palm may be of left-spiralled or right-spiralled one. Data collected are under processing.

(ii) *Exploratory work on the family Arecaceae (Palmae)* : The study relates to the external and internal morphology of different commonly cultivated (economical and ornamental) palms.

(iii) *Studies in the field of natural history of animals, birds, insects, etc.* : The studies include the general behavioral and ecological studies.

#### 2.4.5 EMBRYOLOGY

(i) *Differentiation and Morphogenesis* : The problem of adhesion of cell blastomeres in *Limnaea* has been studied at biochemical and scanning electron microscopic level. The effect of tunicamycin has been tested at the molecular level by measuring the changes in incorporation of  $^{14}\text{C}$ -Mannose and  $^{14}\text{C}$ -N-Acetylglucosamine into glycoproteins. Tunicamycin has no effect on the former and this is in line with certain findings notably, those of Janners who worked with sea urchin. The results with  $^{14}\text{C}$ -N-Acetylglucosamine are difficult to evaluate at the moment and work is continuing. Glycerol, a cryoprotectant, has been reported to exert an effect at the cell membrane. 1-2% glycerol seems to inhibit the cell cement in embryonic *Limnaea*. Here, too, a great deal of variability has been noticed but consistently a very strange effect has been observed, namely, the advanced abnormal trochophore splits up into two separate parts. Some of these results have been recorded cinephoto-micrographically.

(ii) *Wildlife Ecology* : Pheromones and olfaction in leopards were studied. Analysis of pheromone molecules have been performed. A number of DNP-aldehydes have been prepared as standards. TIC and GLC processing was done.

(iii) *Bio-Mathematical and Bio-Statistical Studies in Transcription and Translation during Embryogenesis* : Cellular growth morphogenesis and differentiation during embryogenesis have been further investigated by mathematical and stochastic models. The roles of diffusion of certain macromolecules through cellular gap junctions on the aspects of differentiation and morphogenesis has been investigated. Diffusion drives the system into instability and a cross diffusion acting alone or along with self-diffusion gives rise to a stationary dissipative structure. Stochastic methodology has been explored to investigate gene activities and RNA synthesis. A computer simulation of the stochastic model of transcription has been performed. The simulation closely agrees with the approximate analytical solutions of the stochastic differential equations.

#### 2.4.6 ENTOMOLOGY

(i) Investigations on the breeding of *Anopheles* spp. in two suburban localities (Baranagar and Dum-Dum) : Samples of *Anopheles* larvae (all states) were collected from 100 different sites of Dum-Dum municipality. Malaria-carrying species (*Anopheles annularis*) were observed only on three occasions during monsoon in 1982. Collections round the year show that one species (*Anopheles subpictus*) is already urbanised and is the dominating species of *Anopheles* of the locality (as in Calcutta).

#### 2.4.7 LEAF PROTEIN

A brief account of the broad areas of continuing research work is given below.

(a) Screening of local land and aquatic plants to select promising species for systematic agronomic and biochemical work.

## INDIAN STATISTICAL INSTITUTE

- (b) Agronomical trials on winged bean, a high protein crop are carried out to study the growth habit and yield potential of the crop in this agroclimatic region.
- (c) Studies on the by-products obtained during leaf protein production with the object of utilising fibre and whey as fodder and growth medium respectively.
- (d) Biochemical and nutritional work on the effect of storage on leaf protein concentrates (L.P.C.) as also studies on the possible toxicity and their removal from LPC obtained from non-conventional plants.

### 2.5 SOCIAL SCIENCES

#### 2.5.1 Demography Research

(i) *Evaluation of Family Planning Acceptance 1980-82* : The project was taken up in 1980 in respect of 72 sample villages of 5 districts away from Calcutta. Data collection was completed last year. Further work in various topics of research is in progress.

(ii) *Literacy development among females in rural areas of Maldah and West Dinajpur* : The study showed that literacy percentages of females in family life decreased with increase of distance from Calcutta. Negligible percentages of scheduled tribe women were found literate.

(iii) *Development of Education in rural areas around Patna* : A project has been taken up in rural Bihar on education development in the state. Planning of the survey and selection of villages have been completed. Survey work has been taken up.

(iv) *Socio-economic survey on constraints to development* : A socio-economic study on the present condition and development potential of the Basanti Police Station areas, in the wider perspective of the Sundarbans, West Bengal, was initiated in May, 1981. The study is aimed at identifying the constraints to development and making policy prescription for regional development. Data collection has been completed.

(v) *Three parameter nuptiality curve and its application to Indian data* : The three parameter nuptiality curve has been fitted to the Indian nuptiality data separately for males and females. It appears Coale's method of fitting is not suitable for Indian data. An alternative method based on computer search out programme has been applied and found satisfactory with Indian data.

Preliminary analysis shows substantial difference in the nuptiality patterns between the two sexes.

Apart from the above, the following studies were completed and led to specific findings :

## FIFTYFIRST ANNUAL REPORT : 1982-83

- (vi) Availability of family planning service to the rural population.
- (vii) Sterilisation acceptance in rural areas away from Calcutta.
- (viii) Occupation mobility in rural areas around Calcutta 1978.
- (ix) Disparities of consumer expenditure.
- (x) Indian demographic problems and prospects.
- (xi) Change in female work participation after marriage and husband-wife occupational correspondence.
- (xii) Socio-demographic aspects of divorcees in Bengal.
- (xiii) Primary education and related social indicators.

### 2.5.2 ECONOMICS, ECONOMETRICS AND PLANNING

A. (i) *Economic theory* : Research in economic theory continued on classical and post-classical theories of value and distribution, nature and evolution of technology, analytical representation of productive process in various sectors and associated process of investment, accumulation and innovation, theory of rent, marketed surplus and agricultural pricing. A number of Ph.D. thesis are nearing completion on the topics.

(ii) *Econometric methods* : Studies in this area have analysed statistical problem in the estimation of single equation econometric models and arising from (a) heteroscedastic disturbances, (b) transformation of variables, (c) errors in variables, (d) omission of regressors and misspecification of the equation; (e) Bayesian inference; and (f) time series analysis and forecasting.

(iii) *Measurement of poverty, inequality and income distribution* : Some studies in progress in this area concern issues relating to measurement of poverty, inequality and tax progression. One study examined the procedure for measuring incidence of under-nutrition advocated by Professor Sukhatme.

(iv) *Regional planning* : Research work in progress in this area seeks to cover the following aspects: (a) manufacturing industrialisation and regional production functional analysis in India; (b) monetization of agricultural products and regional surplus-deficit analysis in India; (c) spatial linkage and growth centre analysis in eastern region of India, and (d) synthetic statistical analysis for regional planning in Nepal.

### B. APPLIED ECONOMIC PROBLEMS

(i) *Consumer behaviour and level of living* : Inter-regional and inter-temporal variation in the level of living is being studied on the basis of the 28th round of NSS

## INDIAN STATISTICAL INSTITUTE

household budget data. The processing of the data on the ISI computer is in progress.

Another study of consumer expenditure pattern using NSS time-series data (7th to 28th round) has been undertaken. As a part of this study, system of demand equations is being used.

(ii) *Agriculture* : As part of a broader study of Government policy in respect of pricing, production, procurement and distribution of agricultural commodities, acreage response functions are being estimated for particular crops from state-level time-series data.

(iii) *Industry* : A study on the measurement of productivity in selected manufacturing industries using annual survey of industries data since the mid-sixties is in progress. Another study seeks to analyse trends in the mark-up factor for manufactured products during the Plan period for major individual industries as well as for output of manufactures as a whole.

(iv) *Labour* : Data collected in the ICSSR-sponsored survey of unorganised transport workers in Calcutta is under scrutiny and tabulation at ISI computer in Calcutta.

*C. Rural Survey* : Survey of two clusters of villages in the Memari Block of Burdwan district to study the potentialities and institutional constraints of rural development was taken up during the period. Information on assets held by households, agricultural practices and occupational characteristics of the households in the villages were collected. Data on the use of mechanised equipments like tractors, power-tillers were also collected.

A bench mark survey of the Integrated rural Development Project in two blocks in Coochbehar continued during the period.

*D. Other Surveys* : (i) A project on the 'Relative Prices of Food and the Rural Poor—the Case of India' sponsored by the International Labour Office, Geneva, was taken up in February 1983. The main objective of the study is to analyse the impact of changes in the relative price of food-vis-a-vis non-food items on the levels of living of the rural people. Some preliminary findings have already been reported to ILO.

(ii) As a preliminary step to an All-India survey to estimate the consumption of finished steel in the small-scale unorganised manufacturing sector in India, proposed by the Planning Commission, a feasibility study was conducted in February/March 1983. A report has been prepared and submitted along with a project proposal for the main survey. The survey will be taken up in Delhi and Calcutta on receipt of approval from the sponsoring authority.

### 2.5.3 NATIONAL INCOME RESEARCH

(i) *Preparation of long-term series of capital formation and national income in India from 1857 to 1900* . The study is intended for estimating the two series for the

## FIFTYFIRST ANNUAL REPORT : 1982-83

period between 1857 and 1900. Estimation of capital formation in the public sector at current prices has been completed by March 1982. The estimation of the corresponding series at constant prices is expected to be completed within the next few months. Necessary data were collected from the National Library and other libraries in Calcutta and from the National Archives in New Delhi.

(ii) *Studies on size distributions of income, occupational wage-differentials and related enquiries* : Income distributions among earners in different industry-occupation groups and in different sectors of the economy are being analysed. Studies on the inter-temporal and inter-regional variation in the distributions of income in the public sector, both in Central and State Government services are nearing completion.

A sample survey on wage earnings of employees in different categories of occupations in the small-scale industries in the Calcutta Corporation area was started in February 1983. Two enquiry schedules—one enterprise schedule and another worker schedule—have been drafted. The sample of industrial units to be covered has been drawn from the registers of small-scale industries maintained by the Directorate of Small-Scale Industries in West Bengal. 200 enterprises for filling in the enterprise schedule and 800 workers engaged in these enterprises for worker schedule are proposed to be covered. Data are being collected on wage earnings of sample workers from the employers/managers and also from the workers themselves.

(iii) National accounting and other related studies on economic growth : Estimation of the financial resources for planning in West Bengal, in particular, corresponding to alternative rates of growth of the state domestic products, has been proposed.

An attempt is being made to estimate capital formation, capital-stock and consumption expenditure in West Bengal both at current and constant prices from 1960-61 onwards. A paper on the associated problems of estimation will be ready by November 1983.

(iv) *Estimation of generalized capital formation* : The review of literature on human capital formation has been completed. Indices of educational activities were constructed for the period from 1960 to 1975 for all-India by the method of principal components. Attempts have been made to study the inter-dependence of GDP, physical capital and human capital formation and to study the inter-state disparities in human capital formation in two different time periods.

(v) *Construction of Indices of Development* : The standard measure for economic development is per capita GDP, but, as is well-known, economic development is multidimensional in character. An attempt is being made to construct different types of indices of development using data on 23 variables for 115 countries.

### 2.5.4 LINGUISTIC RESEARCH

The programme of fundamental and applied research is grouped as follows :  
(i) Study of the phonetic structures of major Indian languages and application of the

## INDIAN STATISTICAL INSTITUTE

results in the areas of (1) speech and language habilitation of hearing impaired children (2) second language teaching and (3) cultivation of mother-tongue ; (ii) studies on bi-lingualism and retention of mother tongue and (iii) statistical processing of linguistic data.

### (i) *Phonetic structures of Indian languages :*

(a) *Bengali phonetics :* With regard to the project on articulatory norms in school-going children, the data collected from schools in the Calcutta area were statistically processed and studies are in progress on stability of speech sound and norms for six age groups.

Studies on the suprasegmentals (prosodic feature) of the Bengali language are in progress.

(b) *Hindi phonetics :* Studies are in progress on the suprasegmentals (prosodic features) of the Hindi language, in collaboration with experts on the Hindi language.

The Koster methodology for speech habilitation of hearing impaired children is being adopted for the Hindi language in collaboration with experts in the National Council of Educational Research and Training, Delhi.

(c) *Telugu phonetics :* Studies are in progress on the suprasegmentals (prosodic features) of the Telugu language in collaboration with experts from the Department of Linguistics, Osmania University, Hyderabad.

(d) *Oriya phonetics :* With regard to the study of the articulatory and acoustic phonetic structure of the Oriya language, data on Oriya speech sounds collected in Bhubaneswar and Calcutta have been spectrographically recorded.

(ii) *Studies on bi-lingualism and retention of mother-tongue :* Data collected from two hundred families with Bengali as their mother tongue settled in Teluguspeaking areas, Hyderabad and Secunderabad, on motivation in language choice in the fields of education and vocation were recorded on magnetic tape.

(iii) *Statistical approach to linguistic problems :* Statistical studies are in progress and further studies planned on quantitative linguistic and phonetic data from both Indian and European languages, Bengali, Hindi, Telugu, Punjabi, Oriya, Serbo-Croat and English.

## 2.5.5 PRE-CENSUS POPULATION STUDIES

Research work was continued in search, collection, compilation and analysis of quantitative historical data and socio-economic variables. The major projects were : (a) Pre-census population studies ; (b) Economic changes in rural India and (c) Editing of manuscripts of the Statistical Survey by Francis Buchanan.

## FIFTYFIRST ANNUAL REPORT : 1982-83

### 2.5.6 PSYCHOMETRY

(i) *Development of an intelligence test battery for hard of hearing children* : On the basis of the findings of a pilot study the test for measuring the intelligence level of hard of hearing children was revised. The revised form has been printed and data are being collected from different parts of India. Along with this experimental battery several standardised non-verbal intelligence tests viz., Raven's Progressive Matrices, Alexander Block Design Test, Goodenough's Draw-a-Man Test are also used. In addition to this, a questionnaire is being used to collect biographical information relating to degree and history of hearing impairment, etc.

On the basis of findings on analysis of the data the test battery and the total procedure would be revised and finalised.

(ii) *Isolation of personality pattern and success* : Three groups of data were analysed to form clusters on the basis of distance-function and by applying Q-technique. The final report is likely to be ready by the end of 1983.

(iii) *Popular views of Mental Health* : Processing of data relating to conceptions of mental health continued.

(iv) *Rorschach Psychogram through Computer Programming* : The study aims at drawing a computer model of scoring and interpretation manual of Rorschach Psychogram. The scoring guide and interpretation manual devised with the aid of modern computers can replace the existing system of assessment of personality through Rorschach Psychogram and also minimize the labour and further increase the objectivity by making inter-scores differences negligible. The work has been completed.

(v) *Development of a scale for measuring managerial skill* : The objective of the study is to develop a suitable tool for assessing managerial skill. It is planned to develop the scale in forced-choice method. 100 trials have been formed by matching the items in terms of preference values and the experimental version of the inventory is ready. Data collection using this inventory from different places of India has been started. Scoring key of the scale will be finalised on the basis of iterative item analysis. Reliability and validity of the scale will be determined by using suitable methods.

### 2.5.7 SOCIOLOGY

(i) *Problems of deforestation* : The objective of the study is to identify and quantify the factors influencing the process of deforestation and its consequences on the geographic character of land and species of plants and socio-economic characteristics of the population depending on forest economy. The work on the project is in progress. Analysis of data has started.

(ii) *Social Ecology of Sundarban* : The objective of the study is to explore the possibilities and potentialities of the symbiotic relationship between the societal groups and their natural resources.



## INDIAN STATISTICAL INSTITUTE

An enquiry to explore the feasibility of the study on the basis of available materials has been completed and a report is under preparation.

(iii) *Structure of Social Network and Dimensions of Change* : The objective of the project is to identify patterns of social network in terms of socio-economic and political relationships among various groups in society and study how as well as to what extent these patterns affect impact of development. Data analysis is under progress in collaboration with Stat-Math Division of the Institute.

(iv) *Value systems and social change* : The study intends to identify socio-cultural and political value patterns among various social groups and find out how and to what extent these affect programmes of rural development. It will provide an insight into the dynamics of cultural and valuational factors in the acceptance or rejection of programmes of induced change in rural society and thus be relevant for policy formulation. Field work is in progress. Scrutiny and preliminary tabulation work on the data already collected has been taken up.

(v) *Village re-survey* : Re-survey will indicate changes in rural life in terms of quantifiable variables. It will help to analyse processes of societal changes and provide comparative data overtime. Data analysis is in progress.

(vi) *Problems of social and economic adjustments of persons retiring from active workforce* : The study will examine the ageing of the individual as a social unit. The main issue that would be covered are problems arising out of exclusion of individuals from active workforce. Data analysis is in progress.

(vii) *A study of group relations in Gurdik and surrounding areas with special reference to the development of the scheduled castes and tribes* : Data processing is in progress in regard to the study of group relations with special reference to the impact of development programme on the life and living of the scheduled groups.

(viii) *Study of registry marriage and the impact of legislation in West Bengal* : The object is to study the changing character of marriage institution in West Bengal and the role played by the marriage legislation in effecting this change. It will identify the groups favouring registry marriage, explore the social, economic, cultural and psychological forces behind accepting this and examine the nature and extent of their post-marital adjustments in society. Exploratory inquiry among the registered couples is going on in and around Calcutta and testing of questionnaire schedule is also continuing.

(ix) *Hindu-Muslim relationship in Bengal during the 18th century with special reference to the Fakir and Sanyasi Rebellion* : The Hindu-Muslim relations, which have played an important role in Indian society underwent significant changes after the introduction of British rule. Objective of this project is to collate information and systematically analyse related to the nature and causes of these variations in specific situations after the assumption of political foothold by the English East India Company well as

## FIFTYFIRST ANNUAL REPORT : 1982-83

connection of these variations with the broader changes in the economic base of Indian society. Analysis of materials so far collected is going on.

(x) *Conflict, structure and change* : Explorations in the analysis of agrarian social systems and directed social change : This is an on-going project. Field work and data analysis are continuing.

(xi) *Politics of challenge and change* : Jayaprakash Narayan and concept of total revolution : The book on the project is under preparation.

### 2.6 STATISTICAL QUALITY CONTROL AND OPERATION RESEARCH

2.6.1 As in the past years the activities of the Division were organised through comprehensive programmes under the broad classification of (i) promotion, (ii) training, (iii) plan services and (iv) research. Promotional activities were conducted in public and private sectors. In-plant training of technologists, trainees, inspectors and operatives including the training programme in local languages and services continued to have support from a number of public and private sector organisations. The units of Bharat Heavy Electricals Ltd.—Hyderabad, Haridwar, Bhopal and Jhansi etc. continued as servicing plants of the Division besides a number of other plants both in public and private sectors. Several organisations were added to the list of servicing plants during the period including all the plants under the Steel Authority of India Ltd. (SAIL) initially for a quality survey. The Division undertook new project assignments during the period apart from rendering consultative service to factories already on its rolls. The Division has so far produced about 750 specialists and about 600 research papers, technical literatures, manuals, etc. The Division continued liaison with various academic and technical institutions, productivity councils, societies and several other national and international bodies by way of its academic, technical and promotional activities.

2.6.2 During the period under review 16 plants joined the SQC service scheme. 135 technical reports were sent to factories and 8 factories discontinued. A total of 59 factories are taking consultative services as in March 1983. Special demonstrative studies involving applications of SQC and OR methods were taken up in a number of areas. Some of them are : reducing incidence of broke at major stages of tissue paper, optimisation problem at CO<sub>2</sub> welding, failure of AC coils in motor assembly, optimum sand mix and evaluation of sampling and testing errors, inventory control of insulation items and wood stores, process capability at blade manufacturing and drilling, improvement of quality of top switches for transformers, optimum length of tube and stock to minimise wastage, frequency of redressing notching tools and its impact on productivity and quality, reduction in wastage of copper at bars and coils manufacture, air gap variation in motors, reduction of lay-out time in printing, optimum process condition at manufacture of paraffin wax, electron beam welds, uniformity in drawing silver, control of substance variation in paper, fixing optimum parameters for metal coating, reduction of casting rejections, reliability estimation of PDC, development of sampling plans for capacitors, development of statistical sampling procedure for audit inspection, process

## INDIAN STATISTICAL INSTITUTE

control in turning shop determination of accuracy of height and probabilities of detection from the field of PSM-33, process capability of induction hardening of gear wheels and yield stress properties of compressor impellers during heat treatment life of different types of recirculation valves in boiler feed pumps variation in concentricity readings of utility and industrial rotors, non-conformance in turbine blades, mechanical properties of high tensile brass, rejection of copper strips of stamping machine, cause of malfunctioning of H.I.R safety valves, quality improvement at governor housing casting, defect analysis of sanitary wares, etc.

2.6.3 Inplant training programme at various factories continued. A series of training programmes for senior executives of Bharat Heavy Electricals Ltd. continued on regular basis besides regular in plant programme for executives at various levels. One-year special programme for executives at a fairly advanced level blended with practical applications continued for third and fourth batches of trainees at Madras. Several short-term specially designed training programmes were also conducted at different units of the Division for select group of executives from organisations in India and abroad. During the period under review 5490 managers and technologists were trained in various inplants, general and other courses, 183 trainees underwent professional training in SQC & OR at a post-graduate level and in part-time courses in Calcutta, Bombay, Delhi, Madras, Bangalore and Hyderabad.

2.6.4 Some of the areas in which applied research work was carried out include combinatorial optimisation in flowship scheduling problem, Bayesian three-decision acceptance sampling plans, reliability of cold stand-by system, generalised inverse of M-matrices, optimisation of process parameters in cement processing etc.

## 2.7. LIBRARY, DOCUMENTATION AND INFORMATION SCIENCES

### 2.7.1 Central Library :

(i) With the addition of 2,021 books and 507 volumes of journals the total collection of the Central Library rose to 1,71,893 volumes.

(ii) *Acquisition Unit* : The Unit acquired 2,021 titles, of which 1,477 were purchased and 610 were received as gift. It also acquired 509 titles for the Circulating Library.

(iii) *Technical Processing Unit* : The Unit classified and catalogues 1,273 books and other documents.

(iv) *Periodicals Unit* : The Unit received 2,353 periodicals, of which 734 were received against subscription, 1000 on complimentary basis and 619 on exchange arrangement with national and international organisations. The Library also acquired 56 back volumes of journals. It accessioned 507 bound volumes of journals and completed technical processing of 400 journal titles.

## FIFTYFIRST ANNUAL REPORT : 1982-83

(v) *Membership and circulation* : The total membership of the Library rose to 4,081 which includes ISI staff, NSSO staff, research scholars project assistants, B. Stat. and M.Stat. students, ISEC trainees, etc. as well as outside students and Institute members. On loan and reference 44,392 books and journals were issued to the users. 600 readers were given special permission to use the library for a short period. 51 books and journals were borrowed from other libraries and 124 books and journals were loaned out to other libraries under the inter-library loan arrangements.

(vi) *Reprographic and Photographic Unit* : 94,791 xerox copies were provided to the scientists during the year. 545 frames of photographs of different occasions, 180 frames of scientific coverage, 4,704 copies of Bromide enlargements, 1,534 frames of microfilming from drawing books, charts, journals, etc., 080 copies of photoprints, 230 copies of photostat from big maps and 631 slide for lecture were made.

(vii) *Translation Unit* : The Unit translated one document from English to German and parts of two documents from German to English. Translation of a title from Japanese to English is in progress.

(viii) *Special Materials Unit* : The Unit accessioned 1,568 micro-documents and 140 Russian books. A list of microfilms of the manuscripts of Francis Buchanan was prepared.

(ix) *Circulating Library* : The Workers' Circulating Library acquired 500 new titles, bringing the total collection to 31,488. It issued 36,621 books to the members.

### 2.7.2 Delhi Centre Library

(i) With the addition of 850 new books and 999 bound periodicals, the total collection of the library rose to 21,359. 100 reprints and 250 technical reports in micro-form received had also been added to the stock besides 81 publications received as gift.

(ii) *Acquisition* : 850 books and 999 periodicals were accessioned during the period under review.

(iii) *Technical Processing* : The library classified and catalogued 788 books. Six issues of the bi-monthly 'list of additions' were compiled and published.

(iv) *Periodicals* : The library received 246 periodicals out of which 235 were received on subscription, one on exchange and 10 on complimentary basis. 7 new periodicals titles were added and 5 titles of back volumes acquired. Exchange programme has been established with the Institute of Statistical Mathematics, Tokyo, University de Paris-Sud, Centre D'Orsay, Dedex, Paris and Mathematics Research Centre, University of Wisconsin, Madison, USA.

(v) *Circulation and Stock Maintenance* : The library issued 10,142 books and journals to users on loan and on reference. The total membership of the library came

## INDIAN STATISTICAL INSTITUTE

to 302. Special permission to use the library facilities were given to 132 readers. 160 publications were borrowed from local libraries and 77 publications were loaned out to other libraries on inter-library loan arrangements.

(vi) *Reprography Unit* : 3,321 pages of photo-copies were provided to student, staff and research scholars.

### 2.7.3 Bangalore Centre Library

With the addition of 519 books and 249 bound volumes of periodicals, the total collection of the library rose to 8,536 volumes ; and 133 publications were received on gratis.

(i) *Acquisition* : 519 books and 249 bound volumes of periodicals were accessioned during the period under report.

(ii) *Technical processing* : The library classified 350 books and catalogues 880 books.

(iii) *Periodicals* : The library received 232 periodicals, of which 30 were received on gratis and 202 on subscription. 3 new periodical titles were added.

(iv) *Circulation & Stock Maintenance* : The library issued 6300 books and journals to users on loan and on reference. 500 books and journals were used in the library. 260 inter-library loan transactions were made with the local libraries.

(v) *Library services* : The library rendered the services in addition to the above, viz., reference services, Monthly addition List (books), Fortnightly List of Current Periodicals and Reprographic Services.

### 2.7.4 Documentation Research and Training Centre (DRTC), Bangalore

(i) *Research* : (a) Refinement of the methodology of designing the vocabulary control device called classaurus ; (b) Development of a classaurus for agriculture and related sciences and technologies ; (c) Formulation of rules for specific purpose oriented Postulate Based Permuted Subject Indexing (POPSI specific) (d) Facet analysis of interdisciplinary subjects ; (e) Systems approach to the recognition of Ranganathan's fundamental categories ; (f) Application of forecasting techniques to library management ; (g) Analysis of the classification schemes for medical sciences for the purpose of identifying compatibility between general and special schemes on the subjects concerned ; (h) Design and development of depth classification versions in the field of medical sciences ; (i) Planning and management of information systems and services ; (j) Systems analysis of document circulation system and serial control system in libraries and information centres with a special emphasis on the identification of the various components ; (k) Bibliometric studies for measuring library services and to measure the adequacy of library collection ; (l) Studies on information retrieval based on Bayes theory and Puzay

## FIFTYFIRST ANNUAL REPORT : 1982-83

sets; (m) Development of a computer based system for generating an 'alphabetic' classurus; (n) Developing an alphabetic classurus for leather technology.

(ii) *Training* : The 1982-84 session of DRTC course leading to the award "Associateship in Documentation and Information Science" commenced on 2 August 1982. In all, eight candidates were admitted to the course. There were three deputed candidates. Two of the candidates joined on study leave.

(iii) *Seminary* : 18 seminars were organised and 40 seminars presented.

### 3. CONFERENCES, SEMINAR AND SYMPOSIA

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

(i) A conference on "Quality Control, Reliability and Operational Research" in collaboration with Operational Research Society of India was held at Delhi from 18 February to 20 February 1982.

(ii) A summer school on "Recent Developments in Statistical Methodology" was conducted by the Institute from 9 May to 20 May 1982 at Karnatak University, Dharwar, for university and college teachers and other research workers. An innovation at the summer school was the organization of seminars by the participating students. 25 participants attended this summer school.

(iii) A conference on "Women, Work and Society" was held at the Delhi Centre of the Institute from 22-23 September 1982. 78 participants took part in this symposium of whom 8 were from abroad.

(iv) As a part of the Golden Jubilee celebration of the Institute an international conference on "Frontiers of Research in Agriculture" was organised and held at Calcutta from 27 September to 1 October 1982. The conference was primarily arranged in the form of invited lectures and discussions with a limited number of contributed papers. The following topics were covered at this conference : (a) Strategy for breeding field crops : critique and choices, (b) Agricultural inputs : constraints, new nitrogen sources and energy recycling, (c) Prospects of mixed cropping : intervarietal and interspecies mixture effects—experience and scope of utilization, (d) Post-harvest physiology and estimation of losses of agricultural products due to biotic and abiotic factors, (e) Tapping the non-conventional plants for protein : agronomy, preparation, quality and scope of use, and (f) Edible mushrooms as protein source : present status and future prospects. In addition to these, three special lectures, the inaugural address on 'Statistics and Statisticians for Agricultural Research' by Professor David J. Finney, F.R.S., the second on 'The process view of nutrition and its implications for frontiers of research' by Professor P.V. Sukhalume, F.N.A. and the third on 'India's changing agriculture' by Professor H. K. Jain, F.N.A. also constituted important component of

## INDIAN STATISTICAL INSTITUTE

the conference. 39 participants took part in this conference of whom 11 were from abroad.

(v) A symposium on "Frontiers of Palaeontological and Stratigraphical Research" was held at Calcutta from 4-6 November 1982. 50 participants took part in the symposium of whom four were from abroad. 26 papers were submitted at this symposium.

(vi) A seminar on "Combinatorics and Applications" in honour of Professor S. S. Shrikhande was held at Calcutta from 14-17 December 1982. 45 participants took part in this seminar of whom 14 were from abroad.

### 4. PUBLICATIONS

The following publication were brought out during the year under review :

(i) *Sankhya* : The Indian Journal of Statistics, the official organ of the Indian Statistical Institute :

Series A : Volume 44, Parts 1, 2 and 3

Series B, : Volume 44, Parts 1, 2 and 3

A remarkable progress has been made in regularising and restoring publication schedule as well as distribution of *Sankhya* during the year under review.

Two other publications, namely, (1) Statistical Quality Control and Operational Research in Indian Industries—160 Case Studies, and (2) Organising for Quality—Prospects and Proposals, were also brought out.

The following six Proceedings are going through the press for printing :

- (1) Proceedings of the Golden Jubilee Conference on Statistics : Applications and New Directions.
- (2) Proceedings of the Golden Jubilee Conference on Pattern Recognition.
- (3) Proceedings of the Golden Jubilee Conference on Review of the Indian Planning Processes.
- (4) Proceedings of the Golden Jubilee Conference on Advances in Information Sciences and Technology.
- (5) Proceedings of the Golden Jubilee Conference on Human Genetics and Adaptation.

## FIFTYFIRST ANNUAL REPORT : 1982-83

(6) Proceedings of the Golden Jubilee Conference on Frontiers of Research in Agriculture.

(ii) *Technical Reports* : Thirty-six technical reports from the Statistics-Mathematics group have been issued during 1982-83.

### 5. LIST OF SCIENTIFIC PAPERS AND PUBLICATIONS

#### 5.1 *List of Papers Published*

##### A. Theoretical Statistics and Mathematics

1. Maitra, A. (1982) : An effective Selection theorem, *J. Symbolic Logic*, 47, 389-394.
2. Babu, G. J. (with Singh, Kesari) (1982) : On  $r$ -quick limit sets for empirical and related processes based on mixing rv's. *Journal of Multivariate Analysis* 12, 508-525.
3. — (1982) : Distribution of values of  $w$  in short intervals. *Acta Math. Acad. Sci. Hungar.* 40, 135-137.
4. Bagchi, Bhaskar (1982) : A joint universality theorem for Dirichlet L-functions. *Mathematische Zeitschrift* 181., 319-334
5. Bagchi, Suresh C. (with Sitaram, Alladi) (1982) : Determining sets for measures on  $R^n$ . *Illinois Jour. of Mathematics* 26, 419-422.
6. Bose, Arup (1982) : Asymptotic theory of estimation in non-linear stochastic differential equations for the multiparameter case, *Sankhyā* 45A, 56-65.
7. Dasgupta, Somesh (1982) : *Classification into multivariate normal populations. Handbook of Statistics*, Vol. II. Ed. P. R. Krishnaiah and S. Manna. Academic Press.
8. Ghosh, J. K. (with Sinha, B. K. and Joshi, S. N.) (1982) : Expansion for posterior probability and integrated Bayes risk. *Proc. of Purdue Symp. on Decision Theory, Purdue University, U.S.A.*,
9. — (with Sinha, D. K.) (1982) : Third order efficiency of mlo — a counter example. *CSA Bulletin*.
10. — (with Basu, A. P.) (1983) : Identifiability results for  $k$ -out-of  $p$  systems. *Communications in Statistics*.
11. Mukherjee, Rahul (1982) : Construction of factorial designs with all main effects balanced, *Sankhyā* B44, 154-166.



## INDIAN STATISTICAL INSTITUTE

12. — (1982) : Universal optimality of fractional factorial plans derivable through orthogonal arrays. *CSA Bulletin* 31, 63-68.
13. — (1982) : Univariate stochastic programming with random decision variable. *Jour. Operational Research Society* 33, 957-959.
14. — (with Sinha, Bikas K.) (1982) : A note on the universal optimality criterion for full rank models. *Jour. Statistical Planning and Inference* 7, 97-100.
15. Raha, Asit Baran (1983) : Projectives in some categories of Hausdorff spaces. *Jour. Aust. Math. Soc* 34A, 7-15.
16. Rao, S. B. (with Das, P.) (1983) : Alternating Eulerian trails with prescribed degrees in two edge colored complete graphs. *Discrete Mathematics* 43, 9-20.
17. Rao, T. S. S. R. K. (1982) : Characterizations of some classes of  $L^1$  -preduals by the Alisen-Eltros structure topology. *Israel J. Math* 42, 20-32.
18. — (1982) : Isometries of  $A_2(K)$ . *Proc. Amer. Math. Soc.* 85, 544-546.
19. Sinha, Bikas K. (1982) : On complete classes of experiments for certain invariant problems of linear inference. *Jour. Statistical Planning and Inference*, 7, 171-180.
20. Sahe, G. M. (with Pesotan, H. and Raktoe, B. L.) (1982) : Globally orthogonal regular fractions of the  $s^m$  factorial. *Comm. in Stat. Theor. & Math.* A11 (1),
21. — (with Parstan, H. and Raktoe, B. L.) (1982) : Some results on  $t$ -complete designs. *Ars Combinatorie* 13,

### B. Applied Statistics, Surveys and Computing

1. Chaudhuri, A. (with Adhikary, Arun K.) 1982 : On the relative efficiencies of several strategies for estimating a finite population mean. *Jour. Indian Society of Agricultural Statistics*, 34, 26-34.
2. Chaudhuri, A. (with Arnab, R.) (1982) : Some results concerning strategies of sampling on two occasions. *Journal of Indian Society of Agricultural Statistics*, 34, 1, 61-72.
3. Chaudhuri, A. (with Adhikary, Arun, K.) : On unbiased product-type estimator. *J. Ind. Soc. Stat.* 34, 2, 65-70.
4. Mukhopadhyay, A. C. (1981) : Some series of BOD's BIBD's and SGDD's with Dual Property. *CSA Bulletin*, 30, 115-122.

#### FIFTYFIRST ANNUAL REPORT : 1982-83

5. Roy, J. (with Majumdar, P. P.) (1982) : Distribution and A-B-O- Blood Group in the Indian Subcontinent : A cluster analytic approach : *Current Anthropology*, 23, No. 5.
6. Basu, Anirban (1982) : Performance Analysis of Pipeline Architecture. *Journal of IETE*.
7. Bandyopadhyay, S. (1982) : Covariate Classification Using dependent samples —*The Australian Journal of Statistics*, 24, No. 3.
8. Mukherjee, B. N. (1982) : Measures of Multivariate Relationships for the uniform covariance case—*Behavior-metrika*, 12, 27-35.
9. Maitra, T. (1982) : Expansion of Employment Through Local Resource Mobilisation—Study of a cluster of villages in West Bengal, India : *International Labour Organisation, Asian Employment Programme (ARTEP), Bangkok*.
10. Vijayan, K. S. (1982) : A characterisation of the Simplex, *Aequationes Mathematicae*, 24.
11. Bhimasankaram, P. (with Mathow, T.) (1983) : On the robustness of LRT with respect to specification errors in a linear model. *Sankhyā, Series A*.

#### C. Physical and Earth Sciences

##### 1. Digital Electronics

1. Sinha, B. P. (with Srimani, P. K.) (1983) : Some studies on the characteristic polynomial of a graph—Invited paper in *International Journal of Electronics*, 54, 3, 377.
2. —(with Bhattacharya, B. B.) (1983) : Some new combinatorial problems of distributing distinct objects into non-distinct cells and their engineering applications, *Presented in Seminar on Combinatorics and its applications, Jan 14-17*.
3. — (with Datta Gupta, J. and Sen, A.) (1983) : A cost effective FFT processor using memory segmentation, *IEEE International Symposium on Circuits and Systems*, May 2-4, Newport Beach, California.
4. Ghose, S. (with Sinha, B. P., Datta Gupta, J., Bhattacharya, B. B. and Pal, A.) (1983) : System diagnosability in composite systems, *IEEE, International Symposium on Circuit and Systems*, May 2-4, Newport Beach, California.
5. Pal, A. (1983) : Logic design using digital summation threshold logic gates, *Proc. IEE, Part E*, 130, 1, 32-36,

## INDIAN STATISTICAL INSTITUTE

6. — (with Bhattacharya, B. B.) (1983) : On the design of easily testable cellular digital system, *Proceedings CSI*, January Ahmedabad.
7. Worah, W. W. (with Pal, A., Chakrabarti, M. K.) (1983) : A microprocessor based annunciator system, *Proceedings of CSI-83*, A1.10.01-04. Ahmedabad.

### 2. Fluid Mechanics

1. Chatterjee, A. K. (with Ghosh, A.) (1982) : Finite difference simulation of an estuarine network—A generalised technique, *River Behaviour and Control*, XIV.
2. Dandapat, B. S. (with Gupta, A. S.) (1982) : Thermal instability in a porous media with random vibration, *Acta Mechanica* 43, 37-47.
3. — (1982) : On the non-linear stability of the Eckman boundary layer on a porous plate, *Proc. 11th National Conference on Fluid Mechanics and Fluid Power, B.H.E.L.* CP 23-25.

### 3. Geology

1. Chaudhuri, A (with Maulik, P. K.) (1983) : Trace fossils from continental Triassic red beds of the Gondwana sequence, Pranhita-Godavari Valley, South India. *Palaeogeography, Palaeoclimatology & Palaeoecology*, 41, 17-34.
2. Jain, S. L. (with Berman, D. S.) (1982) : The braincase of a small saurpod dinosaur (Reptilia : Saurischia) from the Upper Cretaceous Lameta Group, Central India, with a review of Lameta group localities. *Annals of Carnegie Museum of Natural History*, 51 (21), 405-422.
3. Kutty, T. S. (with Bose, M. N. and Mubswari, H. K.) (1982) : Plant fossils from the Gangapur Formation, *Palaeobotanist* 39 (2), 121-142.
4. Roy Chowdhury, T. 1981 (1982) : Review of *Evolutionary Biology of the New World Monkeys and Continental Drift*, Plenum Press, *Jour. Indian Anthropol. Soc.* 16, 192-193.
5. Rudra, D. K. (1982) : Upper Gondwana stratigraphy and sedimentation in the Pranhita-Godavari Valley, India *Q. Jl. Geol. Min. Soc. India*, 54, 56-79.
6. Sarker, S. N. (with Chanda, S. K. & Bhattacharyya, A.) (1983) : Compaction in limestone—A reappraisal *Jour. Geol. Soc. India*, 24, 73-92.

### 4. Theoretical Physics

1. Dandyaopadhyay, P. (with Mahalanobis, J.) (1983) : Heavy Ion Collisions at High Energy *Physical Reviews* 27C (USA) 628 .

FIFTYFIRST ANNUAL REPORT : 1982-83

2. Bhattacharya, S. (with Bandyopadhyay, P.) (1983) : Multiple Production Phenomena—Are the jets facts or artifacts? *Hadronic Journal (USA)* 6, 180.
3. Bhattacharya, S. (1982) : New approach to multihadron production phenomenon  $e^+e^-$  annihilations, *Fizika (Yugoslavia)* 14 (3), 177.
4. Roy Choudhury, R. K. (with Roy, S.) (1982) : Stochastic space, time and the concept of Potential in classical and quantum mechanics, *Phys. Rev. D(USA)* 26, 1335.
5. — (1982) : Mass dependence of Scrodinger wave function for an exponential potential—*J. Math. Phys. (USA)* 23, 1628.
6. Brausden, B. H. (with Scott, T., Shingal, R., and Roy Choudhury, R. K.) (1982) : Elastic and inelastic Scattering of electrons by atomic hydrogen at intermediate energies in a coupled channel second order potential, *J. Phys. B(UK)* 15, 4005.

5. Physics

1. Gupta, A. B. (with Ghosh, K. G.) (1982) : Tensile Properties of Normal Human Skin. *Indian Journal of Dermatology*, 27, 1-7.
2. — (1982) : Same disorders of human scalp hair: A tensile study, *XVI Congressus Internationalis Dermatologiae Abstract. Tokyo*, 345-346.
3. — (1982) : Tensile Properties of Scalp Hair in Psoriasis. *Indian Journal of Medical Research*, 75, 616-618.
4. — (1982) : Bursting Properties of Hydrocele and Hernial Sacs. *The Indian Practitioner*, 35, 419-423.
5. — (1982) : Tensiomechanical Properties of Human Appendix. *Science and Engineering*, 35, 67-70.
6. Gupta, A. B. (with Pachal, T. K.) : Family Planning Campaign—A model for evaluation of its activity. *Demography India*, 10, (1981 but published in 1982) 159-161.

6. Electronics and Communication Science

1. Parui, S. K. (with Choudhuri, B. B., Dutta Majumder, D.) (1982) : A procedure for recognition of connected numerals—*International Journal of System Science*, 13, 9, 1019-1020.
2. Choudhuri, B. B. (1982) : Bayes error and its sensitivity in statistical pattern recognition in noisy environment—*International Journal of System Science*, 13, 5, 559-570.

## INDIAN STATISTICAL INSTITUTE

3. — (with Murthy, C. A., Dutta Majumder, D.) (1983) : Bayes error probability for noisy and imprecise measurement in pattern recognition—*IEEE Trans on System, man and cybernetics*, 1, 13, 89-94.
4. Parui, S. K. (with Dutta Majumder, D.) (1982) : A new definition of shape similarity—*Pattern Recognition letter*, 1, 37-42.
5. — (1983) : Symmetry analysis by computer—*Pattern Recognition*, 16, 1, 63-67.
6. Datta, A. K. (with Ganguli, N. R., Roy, S.) (1982) : Maximum Likelihood Method in Vowel recognition—A comparative study—*IEEE Trans on Pattern Analysis and Machine Intelligence*, 4, 6, 683-689.
7. Kundu, Sovonlal (1982) : On a class of linear maps for data compression, *IEEE Trans on Software Engineering*, September 530.
8. Parui, S. K. (with Dutta Majumder, D.) (1983) : Shape similarity measure for open curve—*Pattern Recognition letter*, March 129-134.

## D. Biological Sciences

### (1) Anthropometry and Human Genetics

1. Das, S. K. (with Majumder, P. P. and Basu, A.) (1982) : Demography and demographical genetics of two isolated mountain villages of northern Sikkim, eastern Himalaya. *Journal of the Indian Anthropological Society*, (Calcutta) 17, 155-162.
2. Mukherjee, B. N. (with Reddy, A. P.) (1981) : Genetic study of a Nomadic tribe Kuruvikarans of Andhra Pradesh and Tamilnadu. *J. Ind. Anthropol. Soc.* 16, 179-184.
3. — (with Papiha, S. S. Chahal, S.M.S., Malhotra, K. C. and Roberts, D. F.) (1982) : Genetic heterogeneity and population structure in North-West India. *Ann. Hum. Biol.* London, 9, 235-251.
4. — (with Reddy, A. P. and Sahu, R. N.) (1982) : Study of PGM<sub>1</sub> polymorphism by Iso-electric focusing among the Munda and Kissan tribes of Orissa, *India. J. Ind. Anthropol. Soc.* 17, 69-73.
5. — (with Bandyopadhyay, Shibdas, Malhotra, K. C., Pakrasi, Kanti and Kate, S. L.) (1982) : Effects of Hb types and G-6 PD deficiency on height, weight and skinfolds : a study on Indian population. *Anthrop. Anz.* (W. Germany) 4, 233-243.

FIFTYFIRST ANNUAL REPORT : 1982-83

6. --- (with Roychowdhury, A. K., Blake, N. M. and Kate, S. L.) (1982) : Red cell enzyme polymorphism : gene differentiations in three populations of Maharashtra, India. *Am. J. Phys. Anthropol.* (USA) 59, 367-372.
7. Pakrasi, Kanti (1980) : Population and social development in Assam : A Discussion. *The Bulletin of the Department of Anthropology, Dibrugarh University*, 9, 54-66.
8. --- (with Karmakar, B.) (1981) : On Some Aspects of Marital dissolution in India. *Jour. Ind. Anth. Soc.*, 16, 3, 209-220.
9. --- (with Dasgupta, P.) (1982) : A study on population Composition of the KAORAS. *Bulletin of the Cultural Research Institute* (Govt. of W. Bengal), 15, 1 & 2, 5-15.
10. --- (with Bandyopadhyay, S., Banerjee, A. R. and Banerjee, J.) (1981) : Growth of Bengali Infants by feeding Habit from Birth to Age Twelve Months. *Anthropologion Kotlemenyek* (Hungary), 25, 61-80.
11. --- (with Mukherjee, B. N., Bandyopadhyay, S., Malhotra, K. C. and Kate, S. L.) (1982) : Effects of Hb types and G-6-PD deficiency on height, weight and skin-folds : a study on Indian population. *Anthropologischer Anzeiger* (W. Germany), 40, 4, 233-243.
12. Malhotra, K. C. (with Paptha, S. S., Mukherjee, B. N., Chahal, S. M. S. and Roberts, D. F.) (1982) : Genetic heterogeneity and population structure in north-west India. *Annals of Human Biology* (UK) 9, 235-251.
13. --- (with Chakraborty, R. and Tateno, Y.) (1982) : Variation in dermal ridges in nine population group of Maharashtra, India. *Am. J. Phys. Anthropol.*, 58, 53-57.
14. --- (with Rao, D. C.) (1982) : Path analysis of total palmar pattern ridge counts, *Am. J. Phys. Anthropol.*, 58, 187-189.
15. --- (with Gadgil, M.) (1982) : Ecology of pastoral caste : the Gavli Dhangers of Maharashtra. *Human Ecology* (US) 10, 107-143.
16. --- (1982) : Tongue pigmentation among the Dhangers of Maharashtra and Georgians of Georgia, USSR. *Bionature* 2, (2), 87-88.
17. --- (1980) : Somatoscopic variation among five endogamous castes of Delhi region. *Bull. Dept. Antrop. Dibrugarh Univ.* 9, 441-458.
18. --- (with Chakraborty, R.) (1981) : Dermatoglyphics and genetic distance : a comparative study of variability between populations. *J. Indian Anthropol. Soc.* 16, 262-269.

## INDIAN STATISTICAL INSTITUTE

19. — (with Karmakar, B. and Vijayekumar, M.) (1981) : Diversity in hypothether triradii among some population groups from Indian subcontinent. *Ind. J. Phys. Anthropol. & Hum. Genetics*, 7, 179-188.
20. — (1982) : Regenerations of fodder base for the nomadic pastoral peoples : An experiment in peoples participation. *Environmental services group. New Delhi. Publication No. 5.*
21. — (with Mukherjee, B. N., Pakrasi, K. B., Bandopadhyay, S. and Kate, S. L.) (1982) : Effects of Hb type and G-6PD deficiency on the height weight and skinfolds of persons of various age group of three endogamous populations of Maharashtra. *Anthrop., Antzger* 40, 233-243.
22. — (with Gadgil, M.) (1982) : Ecology of a pastoral caste. *Sovetskaya Ethnographiy*, 5, 107-119.

### 2. Biochemistry

1. Mukherjee, J. J. (with Pal, P. R.) (1982) : Distribution of alkaline inorganic pyrophosphatase in leaves of different families of plants and partial characterisation of the enzyme from *Amarantus blitum* L. *Agric. Biol. Chem.* 46 (11), 2735.
2. Pal, P. R. (1983) : Reversal of serine inhibition of *E.Coli* by B -alamine, *Proc. 70th Indian Science Congress No. 240*, 101.
3. Bhattacharya, S. K. (with Mukhopadhyay, J. J. and Basu, A.) (1981) : Nutritive value of "Chang" an indigenous millet beer of the Sherpas : *Applied Nutrition*, 9, 39-46.

### 3. Crop Science

1. Davis, T. A. (with Ghosh, S. S.) (1982) : Effect of rainfall on production of coconut. *Indian Coconut Journal* 13, (5), 3-7.

### 4. Entomology

1. Daschaudhuri, P. C. : Biology of alimentation in the larva of *Chaoborus crustallinus* De Geer (Diptera : Culicidae) and its significance. *Proceedings of the Zoological Society, Calcutta*, 33, 39-53.

## E. SOCIAL SCIENCES

### 1. Demography

1. Chakravorty, B. (1981) : Demographic effect consequent upon change in age pattern of marriage : An Indian example, *Genus*, XXXVII, 1-2, 111-122.

FIFTYFIRST ANNUAL REPORT : 1982-83

2. ——— (1982) : Rural-Urban mortality differences in States—effects of environmental inequality and other socio economic factors. *Rural Demography*, IX, 1 & 2, 1-6.
3. Datta, Pranati (Miss) (1982) : Trends in the sharing of the gains in productivity in the post independence period in India. *The Indian Journal of Labour Economics*, XXV, 1, 10-14.
4. ——— (1982) : Some indicators of job-satisfaction in Indian industries. *The Indian Journal of Labour Economics*, XXV, 4, 57-62.
5. Ghosal, A. K. : Population control planning in the Indian perspective, *Proceedings of the Seminar on Population Control Planning*, Demography Research Unit, Indian Statistical Institute, Calcutta, 83-87.
6. Guha Roy S. (1982) : Data base relating to mortality in India, *Proceedings of the Seminar on National Health Information System* (under the joint auspices of W.H.O. and Govt. of India), All India Institute of Hygiene & Public Health, Calcutta, 103-110.
7. ——— (1983) : Perspective on Calcutta City Working Age Population, *Proceedings on Seminar on Economy and Employment in Calcutta Metropolitan District, 1983-2001*, Calcutta Metropolitan Development Authority, 61-68.
8. ——— (1982) : Demography of Sterilization : Indian Experience of *Population Headlines*, ESCAP, No. 83, February, 1982. 7-8
9. Malakar, C. R. (1981) : Evaluation of widowhood data in Indian Censuses : A life table investigation, *Genus*, XXXVII, 3 & 4, 165-177.
10. Raman, M. V. : Change in female work participation after marriage and husband-wife occupational correspondence in Calcutta, *Journal of Institute of Economic Research*, XVIII, 1, 10-23.
11. Saha, A. K. : Family welfare planning in rural Bengal, *Proceedings of the Seminar on Population Control Planning*, Demography Research Unit, Indian Statistical Institute, Calcutta, 63-82, (Jointly with Sarkar, B. N.)
12. Sarkar, B. N. : Population Control Planning in India, *Proceedings of the Seminar on Population Control Planning*, Demography Research Unit, Indian Statistical Institute, Calcutta., 6-28.

2. National Income Research

1. Roy, Dina (with Gupta, Swagata & Sen, Nandita) (1983) : Trends in wage-employment relation in the Indian economy, *The Indian Journal of Labour Economics*, XXV, -4, C30-C48.



## INDIAN STATISTICAL INSTITUTE

2. ——— (with Datta, Pranati) (1982) : Trends in sharing the gains in productivity in post-independence period in India : a preliminary examination of certain aspects, *The Indian Journal of Labour Economics*, XXV, No. 1 and 2, 44-61.
3. Roy, Biswensath (1983) : Aspects of industrial relations in agriculture in West Bengal, *The Indian Journal of Labour Economics*, XXV, 4, January, C146-C151.

### 3. Economics, Econometrics and Planning

1. Dutta, Bhaskar (1982) : Multivalued Social Choice functions and strategic manipulation with counterthreats. *Mathematical Social Sciences*, 2, 113-122.
2. Dutta, Bhaskar and Barbara Salvador (1982) Implementability via protective equilibrium, *Journal of Mathematical Economics* 10, 49-66.
3. Majumdar, K. C. (1982) : A Comparative Study of Sixth and Fifth Plan Models *Economic and Political Weekly*, XVII, 35, August-28.
4. Chatterjee, A. K. (1982) : Production of raw jute and price policy, *Capital*, 189, 473f. November 15.

### 4. Psychometry

1. Chatterji, S. and Mukherjee, M. (1982) : Effects of Socio-economic background on the performance in selection *Proceedings of the Seminar on Personnel Selection and Appraisal System*. Jointly organised by Bureau of Public Enterprises and Indian Institute of Psychometry. November.
2. ——— (1982) : Some Selection Variables—*Proceedings of the Seminar on Personnel Selection and Appraisal System*. Jointly organised by Bureau of Public Enterprises and Indian Institute of Psychometry, November.
3. ——— (1983) : How to Select Trainee Pilots' *Productivity* Jan-March XXIII 4, 433-440.
4. Ghosh Anjali (1983) : Self drawing as a measure of intellectual maturity in a group of hearing-impaired children *Proceedings of 70th session of Indian Science Congress, Tirupati*, January.

### 5. Pre-Census Population Studies

1. Bhattacharya, Durgaprasad (with Deb Roy, Rama) (1981) : An Evaluation of Land Reforms in West Bengal-Abridged version. *Board of Revenue, West Bengal*.

FIFTYFIRST ANNUAL REPORT : 1982-83

2. ——— (1982) : On records of village settlements under Regulation VII of 1822 *Proceedings of the 47th Session of the Indian Historical Records Commission, New Delhi.*
3. Bhattacharya, Durgaprasad (with Bhattacharya, Archana) (1982) : Glimpses on Historical Records relating to Calcutta. *Proceedings of the 47th Session of the Indian Historical Records Commission, New Delhi.*
4. Deb Roy, Rama (1982) : An Outline Survey of some Aspects of Technology in India 1750-1900 and its Legacy. *The Indian Journal of History of Science*, 17, 1, 18-27.
5. Chattopadhyay, Kunal (1982) : Transfer of Technology—its relevance in less developed countries with special reference to India. *Economic Studies*, 22, 7-8, 367-370.

6. Sociology

1. Chatterji, Bhola : Published a large volume of articles in both dailies and periodicals.
2. Chattopadhyay, Manabendu (1982) : Role of female labour in Indian agriculture, *Social Scientist* (Trivandrum), 110, July.
3. Chattopadhyay, Manabendu and Ghosh, Sumit Kumar (1983) : Tenurial contracts in a peasant movement belt : An analysis of field survey in Naxalbari, Kharibari and Phansidewa regions of West Bengal, *Economic and Political Weekly* (Bombay), forthcoming.
4. Chakrabarti, Prafulla (1982) : Impact of socio-economic changes on a religious complex : A case study at Tarakeswar, *Journal of Social Research*, XXIII, 2, August, 159-162.
5. ——— (1983) : Some aspects of household organisation and family structures in Calcutta, *The Eastern Anthropologist*, 36, 1, Jan-March.

7. Economic Analysis Unit

1. Rao, P. R. (1982) : Real estate development and resource mobilization, *The Hindu*, July 17.
2. ——— (1982) : Railways : Their contribution to India's Economic woes, *Financial Express*, August 2 & 3.
3. Iyengar, N. S. and Sudarshan, P. (1982) : A method of classifying regions from multivariate data, *Economic and Political Weekly*, XVII, 15, December 18, 2047-2052.

## INDIAN STATISTICAL INSTITUTE

4. Swamy, P.A.V.B., Mehta, J. S. and Iyengar, N. S. : Finite sample properties of the Limited Information Maximum Likelihood Estimator, (to appear in *Sankhyā B*).
5. Iyengar, N. S. and Suryanarayana : On poverty indicators, (to appear in *Economic and Political Weekly*)

### F. Statistical Quality Control

1. Iyer, V. Narayana (1982) : Economic Package Size in Spinning. *Indian Textile Journal*, September.
2. — (with Director of Indian Standards Institution) (1982) : Problems of Small Scale Industries. *QR Views, Quarterly Publication of Indian Association for Quality & Reliability*. September.
3. Narayana, V. (with Sreenivasan, N. S.) (1982) : Product Liability—challenge to Quality. *QR Journal* 9, 2. May.
4. Rau, Y. R. (1983) : SQC Through Applications—Frequency Distributions. *Quality (BIHEL News Letter)* January.
5. Ramamurthy, K. G. (with Jaiswal, N. K.) (1982) : A Two Dissimilar Unit Cold Standby System with allowed down-time. *Microelectronics and Reliability*. 22, 4.
6. Rao Anantha, R. (1982) : Achieving More Uniform Drawing Silver in a Spinning Mill Through Beta Adjustment Factor Techniques. *QR Journal*. September.
7. Roychowdhury, A. (1982) : Replacing Destructive by Non-Destructive Testing. *QR Journal*. September.
8. Anand, K. N. (1983) : Development of Optimum Process conditions in a Chemical Plant producing Paraffin Wax. *QR Journal*. January.
9. Perumallu, P. K. (1983) : Optimum of Parameters for Electron Beam weld Process. *QR Journal*. January.
10. Chowdhury, A. K. (with Adhikari, S.) (1982) : Optimisation of Wave Soldering Process. *IAQR Volume of Technical Papers presented at the 3rd National Convention on Quality & Reliability*. December.
11. Chowdhury, K. K. (with Rao Anantha, R.) (1982) : Optimisation of Hard Carbon Grinding Operation to obtain desired yield. *IAQR Volume of Technical papers presented at the 3rd National Convention on Quality & Reliability*, December.

## FIFTYFIRST ANNUAL REPORT : 1982-83

12. Perumallu, P. K. (1982) : Increasing the Productivity of Inspection through Variable Sampling Plans. *IAQR Volume of Technical papers presented at the 3rd National Convention on Quality & Reliability*, December.
13. Anand, K. N. (1982) : Quality Improvement—An Aid to Higher Productivity. *IAQR Volume of Technical papers presented at the 3rd National Convention on Quality & Reliability*, December.
14. Pal, B. K. (1982) : Supply Quality Assurance—Feldspar. *IAQR Volume of Technical papers presented at the 3rd National Convention on Quality & Reliability*, December.

### G. Library, Documentation and Information Sciences

#### 1. Library

1. Basak, N. D. (with Das, B. B.) (1982) : Organisation of patent information, *ILA Bull.* 18, 1-2 p. 51-58.
2. —(1982) : Survey of information needs for generating information services; a case study. *IASLIC National Seminar, Kanpur*, 10, p. 37-42.
3. — (1983) : Public Libraries (PL) and Adult Education (AE). In *28th All India Library Conference, Lucknow*, Oct. 20-23, Working paper (spousr. India Library Association).
4. Misra, J. (1983) : Planning an integrated science, technical societal information service system (STS1), *Seminar on Cooperation in Information Management, C/o, National Metallurgical Laboratory at Jamshedpur* 14 - 16 Feb.

#### 2. Documentation Research and Training Centre

1. Bhattacharyya, G. (1982) : A source language for organising and associative classifications. (*Library Science with a Slant to Documentation*. 19, paper M).
2. Gopinath, M. A. (1982) : Role of thesaurus in on-line information retrieval. (*Journal of library development* 1, 1 June 30-5).
3. Devanason, F. J. (1983) : Postulate-based permuted Subject Indexing (POPSI) language as a meta language for computer aided generation of information retrieval thesaurus. (*International Forum on Information and Documentation*. 8, 11-20).

## 5.2 PAPERS SUBMITTED/ACCEPTED FOR PUBLICATION

### A. Theoretical Statistics and Mathematics

1. Babu, G. J. (with Singh, Kesar) : Nonparametric inference on means using bootstrap. To appear in *Annals of Statistics*.

INDIAN STATISTICAL INSTITUTE

2. — (with Singh, Kasar) : Edgeworth expansions for sampling without replacement from finite populations. To appear in *Journal of Multivariate Analysis*.
3. Dasgupta, Anirban : Bayes minimax estimation in multiparameter families when the parameter space is restricted to a bounded convex set. To appear in *Sankhyā*.
4. Dasgupta, Somesh : On Anderson's Probability Inequalities. To appear in *Anderson Festach Volume, Stanford University, Ed. S. Karlin*.
5. — :  $TP_1$  and Log-concavity. To appear in *Proc. of Probability Inequality Symposium, Nebraska*.
6. Ghosh, J. K. (with Dasgupta, Anirban) : Some remarks on second order admissibility in the multiparameter case. To appear in *Sankhyā*.
7. — (with Basu, A. P. and Sen, P. K.) : (1983) A unified way of deriving LMP rank tests from censored data. To appear in *JRSS, Ser. B*.
8. Mathew, Joseph (with Nadkarni, M. G.) : A measure preserving transformation whose spectrum has Lebesgue component of multiplicity two. To appear in *Bull. of Lond. Math. Soc.*
9. Mazumder, B. S. (with Ghosh, J. K. and Sengupta, S.) 1982 : Size distribution of sediments deposited from suspension. To appear in *EUROMECH 156. The Mechanics of sediment transport, 12-14 July. Technical University of Istanbul, Istanbul*.
10. — (with Dandapat, B. S.) (1983) : Unsteady free and forced convective diffusion. To appear in *Int. Jour. Engg. Sci., U.S.A*
11. Mukherjee, Rahul (with Rao, T. J.) (1983) : On a problem of allocation of sample size in stratified random sampling. To appear in *Biometrical Journal*.
12. Rao, T. J. (1983) : Some aspects of random permutation models in finite population sampling theory. To appear in *Metrika*.
13. — : On Brewer's class of robust sampling designs for large scale surveys. To appear in *Metrika*.
14. — (1983) : Allocation of sample size to strata and related problems. To appear in *Biometrical Journal*.
15. Saha, G. M. (with Raktoe, B. L. and Pesotan, H.) : On the problem of augmented fractional factorial designs. *Communications in Statistics Theor. and Math.*
16. — (with Kegeyama, S.) : Note on the construction of optimum chemical balance weighing designs. *Annals of the Inst. of Stat. Math.*

FIFTYFIRST ANNUAL REPORT : 1982-83

17. Sinha, Bikas K. (with Gorg, T. M.) : On Neyman's conjecture : A characterization of the multinomials. To appear in the *Jour. Multivariate Analysis*.
18. Dasgupte, Ratan : Large deviation probabilities for U-statistics in non i.i.d. case. To appear in *Sankhya A*.

B. Applied Statistics, Surveys & Computing

1. Adhikari, Arun K. (with Choudhuri, Arijit) : On the efficiency of Midzuno Sen Strategy relative of several ratio type estimators under a model : *Biometrika*.
2. Mukhopadhyay, A. C. (with Mukhopadhyay, S.) : Optimality of Block Designs in a Multiway Heterogeneity set up : *Proceedings of the Golden Jubilee Conference of ISI on 'Statistics'— Applications and New Directions*.
3. Basu, A. : On the performance of multiprocessor system—*Proceedings of CSI '83*.
4. Bandyopadhyay, S. (1983) : Admissibility of likelihood ratio rules in covariat classification using dependent samples. *Australian Journal of Statistics*, April.
5. Mukherjee, B. N. : A Simple Approach to testing a class of covariance structures : *Proceedings of the Golden Jubilee Conference on Statistics : Applications and New Directions*.
6. Chaturvedi, D. K. (with Tripathi, T. P.) (1983) : Estimation of population ratio on two occasions using multivariate auxiliary information—*JISA 21*.
7. Sen, A. : Interpolation Merge—Case for a new Merge Algorithm *Proceedings of the Annual Convention of Computer Society of India*.
8. Chakraborti, S. R. : Optimum Invariant Task on discriminant coefficient or means of multinormal Population with additional information—*J. Stat. Planning and Inference*.
9. Bhimasankaram, P. (with Mathew, T.) : Optimality of BLUES in a general linear model with incorrect design matrix—*Journal of Statistical Planning and Inference*.
10. — : On the robustness of LRT in singular linear model *Sankhyā, Series A*.
11. Adhikari, Arun K. (with Chaudhuri, Arijit) : On optimality of double sampling strategies with varying probabilities : *Journal of Statistical Planning and Inference*
- 12.— : Sampling Strategies with randomised response trials—their properties and relative efficiencies. *International Statistical Review*.
13. Chaudhuri Arijit (with Adhikari, Arun K.) : On double sampling strategies with uniform admissibility and other optimality properties : *Metrika*.

## INDIAN STATISTICAL INSTITUTE

14. — On the efficiencies of unbiased regression and regression type estimators in finite populations : *Australian Journal of Statistics*.
15. Mukherjee, A. C. (with Saha, R.) : On repeated measurement designs : *CSA-Bulletin*.
16. Mukherjee, A. C. (with Mukherjee, S.) : Construction of Balanced, Incomplete Youlden Hyperrectangles : *Journal of Combinatorial Theory, Series A*.
17. Mukherjee, B. N. (with Bhatia, A. S.) : Some Multivariate Procedures for predicting survival in burnt patients, *Statistics in Medicine*.
18. Mitra, T. : Repeat Enquiry on the distribution of public expenditure on social services in West Bengal : *Volume of collected papers on rural poverty edited by Prof. P. K. Bardhan and T. N. Srinivasan*.
19. Chakraborti, S. R. : Some invariant tests of independence of two sets of variates when part of the covariance matrix is known—*Journal of Multivariate Analysis*.
20. Bhimsankaram, P. (with Mathew, T.) : Characterisation of generalized inverses with specified ranks and related ordering properties. *Linear Algebra and its applications*.
21. Sen, A. : On system diagnosis in presence of intermittent fault—*IEEE Transactions on Computers*.
22. Vijayan, K. S. : Arc transitivity in graphs. *Proceedings of the Seminar on Combinatorics and Applications held in honour of Professor S. S. Shrikhande*.

### C. Physical and Earth Sciences

#### 1. Digital Electronics

1. Sinha, B. P. (with Srimani, P. K.) : Some studies on generation of program test paths, in *Information Sciences*.
2. — : Some studies on microprogram optimization in *International Journal of Computer and Information Sciences*.
3. Pal, A (with Bhattacharya, B. B.) (1983) : Easily testable logic design using DSTL arrays', in the *Proceedings of International Conference on Fault Tolerant Systems and Diagnostics, Sept. Czechoslovakia*.
4. Bhattacharya, B. B. (with Gupta, B.) : Anomalous effect of a stuck-at fault in a combinational logic circuit, in *Proc. IEEE*.

5. Sinha, B. P., Dattagupta, J. & Sen, A. : Improvement in speed of FFT processor using segmented memory and parallel arithmetic units, Communicated to *SIGNAL Processing*.
6. Sinha, B. P. (with Bhattacharya B. B.) : On the numerical complexity of bridging fault in logic network, Communicated to *IEEE Trans. Comput.*
7. — : Network bridging faults and Fibonacci numbers, Communicated to *Fibonacci quarterly*.

### 2. Theoretical Physics

1. Bandyopadhyay P., Sarkar, H. (with Bhattacharya, B.) (1983) : Finite quantum Field Theory and Neutrindynamics, *International Journal of Theoretical Physics (USA)*.
2. Bhattacharya, S. (1983) : Secondaries in pp colliders at SPS energies and a Multiple production model, *Fizika (Yugoslavia)*.
3. Siddhanta, J. Roy Choudhury R. K. & Bhattacharya, D. P. : Rigorous saddle point method for cosmic ray integral spectra, *Phys. Rev. D(USA)*.
4. Bhattacharya, Sikha (with Roy Choudhury, R. K.) : Lie transforms and motion of a charged particle in a periodic magnetic field, *International Journal of Mathematics and Mathematical Sciences (USA)*.

### 3. Fluid Mechanics

1. Debnath, K. D., Majumdar A. K. (with Ghosh, A.) : On the flow in a rectangular cavity.
2. Dandapat, B. S., Rajagopal, K. R. (with Gupta, A. S.) : On the nonlinear stability of flow of a conducting fluid past a porous flat plate in a transverse magnetic field, *Archive of Rational Mechanics and Analysis*.
3. Dandapat, B. S. (with Mazumdar, B. S.) : Unsteady free and forced convective diffusion through a channel, *International J. Engg. Science*.
4. Bagchi, B. (with Ghosh, A.) : On the effects of laminar sublayer formed on the conical surface and under the cyclone roof of a hydrocyclone-I. Case of uniform suction.
5. — : On the effects of laminar sublayer formed on the conical surface and under the cyclone roof—Case of Variable suction.
6. Person, L. P. (with Mazumdar, H. P.) : On the transport co-efficients in Turbulent shear flow.



## INDIAN STATISTICAL INSTITUTE

### 4. *Electronics and Communication Science*

1. Choudhuri, B. B. (1983) : An efficient algorithm for Image enhancement—*I.E.E. Proceeding Part-E*, (in press).
2. — : A note on Fast algorithm for spatial domain technique for image processing, *IEEE Trans on System, Man and Cybernetics* (in press).
3. Bates, B. (with Choudhuri, B. B.) : A comparison of several image processing techniques applied to photographically recorded astronomical spectra, *Journal Astronomy and Astrophysics* (in Press).
4. Chanda, B., Choudhuri, B. B. (with Dutta Majumder, D.) : Application of least square estimation for image restoration using signal noise correlation constraint, *IEEE Trans on System, Man and Cybernetics*.
5. Chanda, B., Choudhuri, B. B. (with Dutta Majumder, D.) : Some Algorithm for Image Enhancement Incorporation Human Visual Response, *Pattern Recognition*.
6. Parui, S. K. (with Dutta Majumder, D.) : On preservation of some topological properties of binary picture after digitization, *Information and Control*.
7. Mali, P. C. Choudhuri, B. B. (with Dutta Majumder, D.) : Performance bound of W-H transform for feature selection and compression and some related algorithm, *Pattern Recognition letter*.
8. Chanda, B., Choudhuri, B. B. (with Dutta Majumder, D.) : Some Technique for Image Enhancement, Edge detection and smoothing—*J. Inst Elec and Telecom Eng*.

### 5. *Flume Project*

1. Ghosh, J. K., Majumder, B. S. — Sengupta, S. (1982) : Size distribution of sediments deposited from suspension. EUROMECH 156, *The Mechanics of sediment transport*, 12-14 July, *Technical University of Istanbul, Istanbul*.
2. Mazumder, B. S. (with Dandapat, B. S.) (1983) : Unsteady free and forced convective diffusion, *Int. Jour. Engg. Sci. U.S.A.*

### 6. *Geology*

1. Jain, S. L. : A review of the genus *Lepidotes* (Actinopterygii : Serrioniliformes) with special reference to the species from Kota Formation (Lower Jurassic) India. *Journal Palaeontological Society of India* (Monograph Series).

FIFTYFIRST ANNUAL REPORT : 1982-83

2. Jain, S. L. (with Sahni, Ashok) : Some Upper Cretaceous vertebrates from Central India and their palaeogeographic implications. *Indian Association of Palynostratigraphers. (Proceedings Volume).*

7. Phytles

1. Ghosh, K. G., Ghosh, S. N. and Gupta, A. B. : Tensile Properties of Human Umbilical Cord. *Indian Journal of Medical Research.*
2. Gupta, A. B. (with Ghosh, S. N.) (1983) : Hardness of Human Finger Nails : Normal and Pathological. *11<sup>th</sup> International Symposium in Bioengineering and the Skin, Besancon, France, September 7-9.*
3. Gupta, A. B. (with Ghosh, K. G.) : Tensile properties of human scalp hair in seborrheic capitis. *Indian Journal of Dermatology.*

D. BIOLOGICAL SCIENCES

1. Anthropometry and Human Genetics

1. Basu, A. (with Mukhopadhyay, B.) : (1981) Physical environmental and socio-cultural correlates of demographic characteristics among the Sherpas, and indigenous high altitude population of the eastern Himalayas. *Archivos del Instituto de Biologia Andí (Lima)* (in press).
2. Forsius, H., Basu, A., Gupta, R., Majumder, V., Mukhopadhyay, B. and Bhattacharya, S. K. (1983) : Climatic changes to the eye in medium altitude populations in India : A comparison between Tropical and Arctic populations. *Acta ophthalmologica Scandinavica* (in press).
3. Gupta, R., Das, S. K., Majumder, P. P., Roy, M., Banerjee, S. K., Dey, B., Ghosh, A. K. and Basu, A. (1982) : The Sherpas of eastern Himalaya : A study on genetic polymorphism. *Human Heredity (Basel)* (in press).
4. Mukherjee, B. N. (with Reddy, A. P.) : Gene diversity among the tribes of South and Western India : Distance analysis in ten tribal groups. *Colloquium Anthropologicum (Yugoslavia).*
5. ——— (with Das, S. R.) : Haptoglobin : Genetics and variation in Indian populations. *Ind. J. Phys. Anthropol. Hum. Genet.*
6. Mukhopadhyay, B. (1982) : Selection intensity in the Lepchas of Kalimpong, West Bengal. *Current Anthropology (Chicago)*
7. Mukherjee, B. N. (with Reddy, A. P., Das, S. K., Malhotra, K. C. and Ramchandrab, T.) : A serological and biochemical study among the coastal and Plateau Yandis : A trival population of Andhra Pradesh *HOMU* (W. Germany).

INDIAN STATISTICAL INSTITUTE

8. ——— (with Joshi, S. H., Dixi, A. J., Malhotra, K. C. and Kate, S. L.) : Incidence of Hepatitis B (Australia) Antigen among three communities in Malarial Western Maharashtra, India, *Human Hered.* (Denmark).
9. ——— (with Reddy, A. P.) : Wide spread distribution of LDH in various ethnic groups of India. *SAP* (New Delhi).
10. ——— (with Malhotra, K. C., Das, Rajkumar, Bandyopadhyay, S. and Kate, S. L.) (1982) : Spatial and social variation in Sickle celltrait, G-6PD deficiency and Malarial incidence in North Maharashtra : A preliminary report, *Proced. Conf. Hum Genet, Adapt. Golden Jubilee ISI 1982*.
11. Mukherjee, B. N. (with Kate, S. L., Phadke, M. A. and Saihani, G. S. (1982) : Study of enzyme plasma cholesterase variants amongst different population groups of Maharashtra, India. *Proced. Hum. Genet Adapt. Golden Jubilee, ISI*.
12. ——— (with Sauber Piter, Walter, H. and Malhotra, K. C. (1982) : Isoelectric focusing in the detection of extended genetic polymorphism of PGM1 in ten endogamous groups of West Bengal and Orissa, India. *Proced. International symposium on Recent advances in Immunohaematology, Bombay 23-25. October, (organised by B.G.R.C. ; ICMR)*.
13. ——— (with Shirdas Bandyopadhyay, Malhotra, K. C., Pakrasi, Kanti and Kate, S. L.) : Effect of Hb types and G-6PD-deficiency on the height, weight and skin-folds of persons of various ages of three endogamous populations of Maharashtra under publication sh in *Recent Advances in Human Biology*.
14. Pakrasi, Kanti (with Basumallick, T., Chowdhury, S. and Chakraborty, N.) *The Mentally Handicapped Children of Eastern India : A Biosocial Study (Social Biology, USA)*.
15. ——— (with Sil. S. and Desgupta, P.) : Body weight at Birth and Incidence of Low-weight Babies in Calcutta (India) (*ROMO*, West Germany).
16. Malhotra, K. C. (with Gadgil M.) : The Indian caste system : an ecological perspective, *Annals of Human Biology, UK*.
17. ——— : Science in the service of people : A model for field research. *Proc. seminar on Action Research in Social Sciences, Ind. Inst. of public Administration, Delhi*.
18. ——— : Subsistence strategies among the nomads of western India. In *Anthropology of the people of South Asia. J. R. Lukacs (ed)*.
19. ——— : Population structure of Indian populations. In *Anthropology of the people of South Asia. J. R. Lukacs (ed)*.

FIFTYFIRST ANNUAL REPORT : 1982-83

20. ---- (with Gadgil, M.) : Coping with uncertainty in food supply: case studies among nomads from West India.
21. ---- (with Khosla, S. B. and Gadgil, M.) : Hunting strategies among the non-pestoral nomads. *Man in India*.
22. ---- (with Karmakar, B.) : Simian Cresset variation in 12 population groups of north west India. In *Biology of the people of north-western India*. Moscow.
23. Malhotra, K. C. (with Karmakar, B.) : Qualitative finger dermatoglyphic differentiation among 12 north-western Indian populations. In *Biology of the people of north-western India*. Moscow.
24. ---- (with Mukherjee, B. N.) : Incidence of colour blindness in 14 north-western Indian populations. In *Biology of the people of North-western India*.
25. ---- Incidence of colour blindness in 14 north-western Indian populations. In *Biology of the people of North-western India*.
26. Malhotra, K. C. (with Karmakar, B. and Chopra, E. P.) : Palmar pattern ridge count differentiation in Indian populations. In *Biology of the people of north-western India*.
27. ---- (with Papiha, S. S., Mukherjee, B. N., Chahal, S. M. S. and Roberts, D. F.) : Genetic heterogeneity among the people of Western India.
28. ---- (with Mukherjee, B. N., Das, S. K. and Banerjee, S. K.) : Serum protein and enzymes variation in north-west India. In *Biology of the people of north-west India*.
29. Malhotra, K. C. : Social and economic implications of development : Some case studies. *Ind. Inst. of Management, Bangalore*.
30. ---- (with Mukherjee, B. N., Sauber, P. and Walter, H.) : Isoelectric focusing in the deflections of PGM<sub>1</sub> in ten endogamous populations of W. Bengal. *HOMO*.
31. ---- (with Mukherjee, B. N., Reddy, A. P., Walter, H. and Sauber, P.) : Transferrin sub-typing by isoelectric focussing in three Western West Bengal populations. *Z. Morph. Anthrop.*

2. Biochemistry

1. Mukherjee, J. J. and Pal, P. R. (1983) : An alkaline magnesium dependent inorganic pyrophosphatase from the leaf of *Amarantus blitum* L., *Agric. Biol. Chem.* 47, 6.

## INDIAN STATISTICAL INSTITUTE

### 3. Crop Science

1. Ghose, M. (1982) : The anatomy of roots in young palms. *Journal of Indian Botanical Society*.

### 4. Leaf Protein

1. Chanda, S. : Use of deproteinized leaf juices for growth of microorganisms. Accepted for publication in *Indian Journal of microbiology*.

## E. SOCIAL SCIENCES

### 1. Demography

1. Chakravorty, B. : Areas and Approaches to Psychological Research in Human Reproduction Behavior, Family Planning Programme and Policy Decisions. *Indian Journal of Psychology*.
2. ——— : Determinants of Child Education in India. *Man and Development*.
3. ——— : Female Education, Female Labour Force Participation and Fertility : An Interactive Cause Model Approach. (*Indian Economics*).
4. Guha Roy, S. : Developing Model Schedules of Female Proportions Single for India. (*Population Studies*).
5. ——— : Female Nuptiality in India : A reconstruction. (*Asia and Pacific Census Forum*).
6. Malaker, C. R. : Regression Analysis in Demographic Research Problems and Remedies. (*Proceeding of the IASP Workshop*).
7. Raman, M. V. : Opinion of Calcutta men on arranged marriage (*Indian Journal of Social Research*).

### 2. Economics, Econometrics and Planning

1. Dutta, Bhaskar and Govers, L. : On majority rule allocations of a shrinking Cake, *Review of Economic Studies*.
2. Dutta Bhaskar, and Chakrabarty, Satya Ranjan and Weymark, John : Ethical Indices of Mobility. *Journal of Economic Theory*.
3. Dutta, Bhaskar : Acceptable game forms and effectivity functions, *Econometrica*.

FIFTYFIRST ANNUAL REPORT : 1982-83

8. Linguistic Research

1. Kostić, Djordje and Mitter, Alokannanda (1982) : *Tests for Articulatory Evaluation of Speech Sounds : Method and Application*. Indian Statistical Institute.
2. ——— (1982) : *Tests for Articulatory Evaluation of Bengali Speech Sounds*.
3. Kostić, Djordje, Rastogi, K. G., Mitter, Alokannanda (1982) : *Tests for Articulatory Evaluation of Hindi Speech Sounds*.
4. Kustić, Djordje, Krishnamurti, B. H. and Mitter, Alokannanda (1982) : *Tests for Articulatory Evaluation of Telugu Speech Sounds*.
5. Cardes, Dorothy (1982) : *The Kostić Methodology for linguistic habilitation* (Reprint by permission of the Djordje Kostić Institute for Audio-Linguistic Studies, Inc. USA).

4. National Income Research

1. Mazumdar, Krishna : A dual economy model, submitted for publication in the *Quarterly Journal of Economics*.
2. ——— (with Bhattacharyya, B. N.) : Changes in structure of the urbanization of big cities in India *Journal of Indian Regional Science*.

5. Pre Census Population Studies

1. Bhattacharya, Durgaprasad (with Deb Roy, Rama) : An evaluation of Land Reforms in West Bengal. Final Report. Submitted to the Land Reforms Commissioner, West Bengal.
2. Chattopadhyay, Kunal : Tourism, its economic viability in the developing world, *Economic Studies*.

6. Psychometry

1. Chatterji S. and Mukherjee M. : Accuracy of Self assessment and its relation with some psychological & biographical factors. *Jr. of the New Zealand Psychological Society*, New Zealand. (Accepted for publication).
2. Chatterji, S. and Mukherjee, M. : Relation of intelligence to neuroticism among school going children, slum children and inmates of a detention home. *Psychologia*, Kyoto, Japan, (Accepted for publication).
3. Banerjee, S. N. : Computer model of scoring of Rorschach responses. *American Journal of Psychology*, Illinois, U.S.A.

## INDIAN STATISTICAL INSTITUTE

- Mitra, S. K. : Analysis of educational flow in primary courses of a region : A Markov chain approach. *Journal of Education and Psychology*, Sardar Patel University, Vidyanagar, Gujrat.

### 7. Sociology

- Chettopadhyay, Manabendu (1984) : Transformations of labour use in Indian agriculture, *Cambridge Journal of Economics* (England) 8, 1, March.
- (with Halder, S.) (1983) : Labour and modes of production, *Society and Change* (Calcutta) June.
- : *Labour tenure and farm efficiency, Labour, Capital and Society* (McGill University, Montreal, Canada).
- (with Chatterjee, A. K.) : Agrarian relations in a North Bengal peasant movement belt : Historical evolutions and contemporary situations, *Indian Economic and Social History Review* (Delhi School Economics), Delhi.
- (with Ghosh, S. K.) : Poorer among the poor, *Social Scientist*, Trivandrum.
- Chakrabarti, Prafulla : Some aspects of complex families in Calcutta, *Journal of Comparative Family Studies*. Canada.
- Mukherjee, Partha Nath : *Sarvodaya after Gandhi : Contradiction and change, Lokayan*, Delhi.

### 8. Economic Analysis Unit (Bangalore Centre)

- Harish, S. and Iyengar, N. S. : On modified LIML estimators, (*Sankhyā B*).
- Swamy, P. A. V. B., Mehta, J. S. and Iyengar, N. S. : Convergence of the moments of the modified k-class estimators, (*Sankhyā B*).
- Suryanarayana, M. H. : Treatment of poverty in the Sixth Plan, (*Artha Vijnana*).

### F. Statistical Quality Control

- Mohan, S. R., Ramamurthy, K. G. and Neumann, M. : Non-negativity of Principal Minors of Generalized Inverses of M-Matrices, *Linear Algebra and its Applications*.
- Pandey, R. J. : Bayesian Three-Decision Sampling Plans by Attributes for Beta prior distribution, *Journal of Quality Technology*, USA.

FIFTYFIRST ANNUAL REPORT : 1982-83

G. Library, Documentation and Information Sciences

1. Seetharama, S. : Reference Framework : An aid to information analysis and consolidation. (with Prof. A. Neelamegham).
2. Dr. Ravichandra Rao, I. K. : Quantitative Methods for Library and Information Science.

5.3 PAPERS READ AT CONFERENCES AND TO BE PUBLISHED IN CONFERENCE PROCEEDINGS

A. Applied Statistics Surveys & Computing

1. Adhikary, Arun K. : On Sampling Strategies with randomised response trials and their properties and relative efficiencies, Presented in the 70th Session of Indian Science Congress held at Tirupati.
2. Maitra, T. (1982) : Some distributional aspects of public services in nationalised consumptions—presented in the Seminar on Public Services in National Consumption. Concepts, Evaluation and Measurement held at Kodakanal during 5-8 October, under the auspices of Indian Association for Research in National Income and Wealth.
3. Roy, J. & Bhattacharyya, P. K. (1982) : Analysis of long term experiments on tea—Presented in the ISI Golden Jubilee Conference on Frontiers of Research in Agriculture held during 27 September to 1 October.

B. Physical and Earth Sciences

1. Electronics and Communications Science

1. Chand, B., Choudhuri, B. B., Dutta Majumdar, D. (1982) : A restoration technique for biomedical image blurred due to defocussing effect, Proc. of IEEE Computer Society Symposium on Medical imaging and Image Interpretation, Berlin (W. Germany), October, (p. 14-19).
2. Parui, S. K. & Dutta Majumdar, D. (1982) : Estimation of Fuzzy membership function, Proc 6th International Conference on Pattern Recognition (of International Association for Pattern Recognition) Munich (W. Germany) Oct.
3. Dutta Majumdar, D., Das, J., De, A. K. (1982) : A mixed approach for classification of E. C. G. Signals, Proc. IEEE Comp. Soc. Sump. of Medical imaging and Image interpretation, Berlin (W. Germany) October (p. 188-194).



## INDIAN STATISTICAL INSTITUTE

4. Chanda, B., Choudhuri, B. B. & Dutta Majumder, D. (1982) : Experimental Algorithm for image enhancement, edge detection and restoration, *Proc. Colloquium of Mathematical Morphology, Stereology and Image Analysis*, Prague, September (Czechoslovakia).
5. — (1983) : An efficient best square biomedical Image restoration using image noise correlation constraint, *Proc. 26th Tech. Convention of I.E.T.E.*, February Hyderabad.
6. Parui, S. K., Sharma, S. E. & Dutta Majumder, D. (1983) : Shape analysis by Computer, *Proc. C.S.I. Conference*, January, Ambedabad.
7. Roy, K. S. & Dutta Majumder, D. (1983) : A fuzzy linguistic control for decoupling a non-linear Multivariable plant, *Proc. Conference C.S.I.*, January (Ahmedabad).
8. Dutta, A. K., Gauguli, N. R. & Dutta Majumder, D. (1982) : Speech and music-A review on quantitative studies, *National Symposium on Acoustics*, N.P.L., New-Delhi, September.
9. Pramanik, S. K., Roy, K. S. & Dutta Majumder, D. (1983) : Clustering in Mixed environment (Fuzzy and Non-Fuzzy) by branch and bound technique for Management Application, *Proc. of International Federation of Automatic Control Symposium to be held in July MARSELLIE (France)*.
10. Roy, K. S., Dutta Majumder, D. (1982) : A conceptual study on Modification of power plant Instrumentation and Control, *Proc. Symp. on Instrumentation Recent trends in Research and Development, I.E.T.E.*, June (Calcutta).
11. Kundu, M. K. & Dutta Majumder, D. (1982) : Studies on some cost effective schemes in Iron and Steel making Industry, *Proc. Symp. on Inst., Recent trends in Research and development IETE* June (Calcutta).
12. Pramanick, S. K., Chanda, N., Das, J. & Dutta Majumder, D. : Design of distributed processor system biomedical instrumentation and their optional assignment in time varying demand.
13. Roy, K. S., Dutta Majumder, D. (1983) : Guidelines for the measurement of combustion inside the furnace of steam generating unit, *Proc. 28th tech. Convention of IETE*, February, Hyderabad.

## 2. Geology

1. Jain, S. L. (1982) : A review of the genus *Lepidotes* (Actinopterygii + Semionotiformes) with special reference to the species from Kota Formation (Lower Jurassic), India. Symposium on "Frontiers of Palaeontological and Stratigraphical Research.", *I.S.J.* 4-6 November, Abstracts, 21-22.

FIFTYFIFTH ANNUAL REPORT : 1982-83

2. — (with Sahni, Ashok) (1982) : Some Upper Cretaceous vertebrates from Central India and their Palaeogeographical implications. Symposium on "Cretaceous of India : Palaeoecology, Palaeogeography and Time boundaries", Birbal Sahni Institute of Palaeobotany, Lucknow, 24-26 November.
3. Kutly, T. S. (with Roy Choudhury, T., Rudra, D. K. & Bandopadhyay Saswati) (1982) : Upper Gondwana stratigraphy of the northern part of the Pranhita Godavari Valley, Deccan India. Symposium on "Frontiers of Palaeontological and Stratigraphical Research", I.S.I., 4-6 November, Abstracts, 18-19.
4. Maulik, P. K. (1982) : Continental Tracofossils from the Triassic red beds of the Pranhita-Godavari Valley. Symposium on "Frontiers of Palaeontological and Stratigraphical Research", I.S.I., 4-6 November, Abstracts, 27.
5. Roy Chowdhury, T. (1982) : Skeletal responses to gigantism in sauropodomorph dinosaurs. Symposium on "Frontiers of Palaeontological and Stratigraphical Research", I.S.I., 4-6 November, Abstracts, 26-27.
6. Rudra, D. K. (1982) : On the Lower Jurassic Kota Limestones of the Pranhita-Godavari Valley, Deccan India. Symposium on "Frontiers of Palaeontological and Stratigraphical Research" I.S.I., 4-6 November, Abstracts, 14-15.

A conference on "Frontiers of Palaeontological and Stratigraphical Research" was organised by the Institute during the 25th anniversary of the Geological Studies Unit at Calcutta, 4-6 November, 1982. During the Symposium 26 papers were presented, including 4 from abroad. It was attended by about 50 delegates.

3. Physics

1. Gupta, A. B. & Ghosh, K. G. (1982) : Age, Sex and Site Variations of Human Scalp Hair. International Seminar on Genetics and Public Health, IXth Annual Conf. of Indian Society of Human Genetics. December 10-13, Bhopal.
2. — (with Ghosh, S. N.) (1983) : Responses of Human Skin to in vitro uniaxial loading. XIth National Conf. of Indian Association of Dermatologists, Venereologists and Leprologists, January 20-23, Mangalore.
3. Ganguly, S. & Mukherjee, T. K. (1983) : Design of non-interacting controller for 2-shaft Gas-turbine. 26th Technical Convention of the Institute of Electronics and Telecommunication Engineers. February 12-14, Hyderabad.

C. Biological Sciences

1. Anthropometry & Human Genetics

1. Malhotra, K. C. (1982) : Coping with uncertainty in food supply : case studies among the nomads of Western India. Presented at the Conference coping with Uncertainty in food supply. Badlionn-burg, West Germany, December, 13-15.

## INDIAN STATISTICAL INSTITUTE

2. Bharati, P. & Basu, A (1982) : Uncertainties of food supply, and nutritional deficiencies in relation to economic condition in a village population of southern West Bengal, India *proceedings of the symposium on coping with uncertainties of food supply*, Bad Homburg, West Germany, December.
3. Mukherjee, B. N. & Reddy, A. P. (1982) : Isoelectric focusing in the detection of genetic microheterogeneity of proteins in Indian populations, *Annual Conference of the Indian Society of Human Genetics*, Bhopal. 10-13, December.
4. — (with Sauber, Piter, Walter, H. & Malhotra, K. C.) (1982) : Isoelectric focusing in the detection of extended genetic polymorphism of PGM1 in ten endogamous groups of West Bengal and Orissa, India. *International Symposium on Recent advances in Immunohaematology*, Bombay, 23-25 October.
5. Pakrasi, Kanti (1983) : Marriage system and its Impact on Family Formation and Family Planning (submitted to the conference on *Recent Population Trends in South Asia*, New Delhi, February 2-8.

### 2. Botany

1. Roy, S. K. (1982) : Breeding strategy for rice improvement : a critique. *ISI Golden Jubilee International Conference on Frontiers of Research in Agriculture*, Calcutta, September 27- October 1.
2. — (1982) : Inter-variatal and inter-species interactions in crop plants : Indian Experience. *ISI Golden Jubilee International Conference on Frontiers of Research in Agriculture*, Calcutta, September 27- October 1.
3. Roy, S. K. (with Banerjee, R. N.) (1982) : Assessment of pre-harvest losses of winter paddy caused by rodents. *ISI Golden Jubilee International Conference on Frontiers of Research in Agriculture*, Calcutta, September 27—October 1.
4. — (1982) : Rodent control strategy : a behavioural study of field rats (Invited lecture). *Silver Jubilee Celebration Conference of the College of Agriculture, University of Calcutta and the Agricultural Society of India on Agriculture in 1980s*, Calcutta, December 13-16.

### 3. Crop Science

1. Ghose, M. (1983) : The cell inclusions in vegetative structures of young palms. *5th All India Botanical Conference held at Raj Kot Dec. 27-30, 1982.*
2. Ghosh, S. S. & Davis, T. A. (1983) : Exploitation of the branching habit and bulbil formation for obtaining numerous identical progeny in some species of palms. *70th Indian Science Congress Session held at Tirupatt*, Abs. no. 376, P. 145.

## FIFTYFIRST ANNUAL REPORT : 1982-83

### 4. Leaf Protein

1. Matai, S., Bagchi, D. K. & Chanda, S. (1982) : Leaf Protein yields and factors controlling them in leguminous crops in West Bengal. *International Conference on Frontiers of Research in Agriculture*, held on September 27 to October 1, at ISI Calcutta.
2. Bagchi, D. K. (1982) : Nitrogen nutrition and extracted leaf protein yields of four crops grown in Gangaic alluvium soils. *International Conference on Frontiers of Research in Agriculture* September 27 to October 1, at ISI, Calcutta.
3. Chanda, S. (1982) : The whey utilization for paucillin production, present status and future prospects. *International Conference on Frontiers of Research in Agriculture*, September 27 to October 1, at ISI, Calcutta.
4. Bagchi, D. K., Matai, S. & Banerjoe, A. (1982) : Selection of crops for leaf protein production in West Bengal—a critique. *First International Conference on Leaf Protein Research held in Aurangabad*, October 5-8.
5. Matai, S., Bagchi, D. K., Chanda, S., & Banerjoe, A. (1982) : Screening of local vegetation for leaf protein in West Bengal. *First International Conference on Leaf Protein Research held in Aurangabad* October 5-8.
6. Chakrabarti, S., Bagchi, D. K. & Matai, S. (1982) : Use of by-product leaves of some vegetable crops as source of protein based on some nutritional parameters. *First International Conference on Leaf Protein Research held in Aurangabad*, October 5-8.
7. Chanda, S., Chakrabarti, S. & Matai, S. (1982) : Whey as the medium for production of microbial metabolites and biomass. *First International Conference on Leaf Protein Research held in Aurangabad*, October 5-8.

### D. Social Sciences

#### 1. Demography

1. Chakravorti, B. (1982) : Disparities in consumer expenditure and mortality in India, paper read at the *Eighth Annual Conference of the Indian Association for the Study of Population*, 29-31 December, Indian Institute of Family Welfare, New Delhi (Proceedings of the Annual Conference).
2. Datta, Pranati (Miss) (1983) : Some indicators of job satisfaction in Indian industries, paper read at the *24th Conference of the Indian Society of Labour Economics*, 17-19 January Chandigarh University (Proceedings of the Conference).

INDIAN STATISTICAL INSTITUTE

3. Ghosal, A. K. (1982) : Some aspects of national integration, paper read at the *Seventh Social Science Congress, Indian Academy of Social Sciences, Allahabad*, 12-15 June, IIT, New Delhi (Proceedings of the Social Science Congress).
4. Guha Roy, S. (1982) : Data base relating to mortality in India, paper read at the *National Seminar on National Health Information System*, (under the joint auspices of WHO and Govt. of India), All India Institute of Hygiene and Public Health, Calcutta 9-10 December (Proceedings of the Seminar).
5. Malaker, C. R. (1982) : Regression analysis in demographic research, paper presented in the *Workshop on Recent Advances in the Techniques of Demographic Analysis*, International Institute of Population Studies, 2-6 November, (Proceedings of the Workshop).
6. Saha, A. K. (1982) : Availability of family welfare service to the rural population of Bengal, paper read at the *Eighth Annual Conference of the Indian Association for the Study of Population*, 29-31 December, Indian Institute of Family Welfare, New Delhi (Proceedings of the Annual Conference).
7. Sarker, B. N. (1982) : Demographic aspects of National integration, paper read at the *Seventh Social Science Congress, Indian Academy of Social Sciences, Allahabad*, 12-15 June, IIT, New Delhi (Proceedings of the Social Science Congress).
8. — (1982) : Disparities in interstate consumer expenditure, paper presented in the *Seminar on Recent Developments in the Techniques of Population Analysis and Statistical Inference, Banaras Hindu University*, 23-25 October (Proceedings of the Seminar).
9. Sarker, B. N. (1982) : Indian demographic dimension : problems and prospects, paper read at the *workshop on Work Education, International Labour Institute*, 22-24 November, Central Board for Workers Education, Calcutta, (Proceedings of the Workshop).
10. — (1982) : Occupation Mobility in rural areas around Calcutta, paper read at the *Eighth Annual Conference of the Indian Association for the Study of Population*, 29-31 December, 1982, Indian Institute of Family Welfare, New Delhi (Proceedings of the Annual Conference, 1982).
11. — (1983) : Prospect of health service distribution to the rural population, paper presented in the *Seminar on the Role of Behavioural Sciences in Community Medicine with Special Reference to the Weaker Section of the Society*, 22-24 Feb. 1983, All Indian Institute of Hygiene and Public Health, Calcutta, (Proceedings of the Seminar).

FIFTYFIRST ANNUAL REPORT : 1982-83

2. *National Income Research*

1. Roy, Bina, Gupta, Swagata & Sen, Nandita (1983) : Trends in wage-employment relation in India, presented to the 24th Annual Conference of the Indian Society of Labour Economics held at Chandigarh, January 17-19.
2. Roy, Bina (1983) : Inter-sectoral flow of capital goods in India, presented to Annual Conference of the Centre for urban economic studies in West Bengal, Calcutta University, Economics Department, 25-26 March.
3. Sen, Nandita (1983) : Problems of rehabilitation of jute industry in West Bengal, read at the 3rd Annual Conference of the Bangiya Arthaniti Parishad, Jadavpur University, 26-27 March.
4. — (1983) : Impact of towns on village socio-economic life, presented to the Annual Conference of the Centre for Urban Economic Studies in West Bengal, Calcutta University, Economics Department, 25-26 March.
5. Roy, Biswanath (1983) : Aspects of industrial relations in agriculture in West Bengal, presented to the 24th Annual Conference of the Indian Society of Labour Economics, Chandigarh, January 17 to 19.

3. *Pre-Census Population Studies*

1. Bhattacharya, Durgaprasad (with Deb Roy, Rama) (1982) : On Records of Mysore Survey, 1800-1815. *Indian Historical Records Commission, 48th Session, Ahmedabad, 5-6 June.*
2. — (1982) : A Note on Land Reforms in West Bengal. *Third Annual Conference on Institutional Changes in Agriculture and Regional Development, Bhopal, M.P., State Planning Board, November 27-29.*
3. Bhattacharya, Durgaprasad : Scientific Writings in Some Major Indian Languages in the 19th Century—A Preliminary Survey Submitted to Council of Scientific and Industrial Research for a Seminar on the Nature and Character of Science introduced by the British and its Impact on India.
4. Deb Roy, Rama : The Great Trigonometrical Survey of India in a historical perspective. Submitted to Council of Scientific and Industrial Research for a seminar on the Nature and Character of Science introduced by the British and its impact on India.

4. *Economic Analysis Unit*

1. Iyengar, N. S. & Suryanarayana, M. H. (1982) : On poverty indicators, presented at the Planning Commission's First Conference on Regional Development Index and Co-operation, Maitital, April 20-22, to appear in a volume.

## INDIAN STATISTICAL INSTITUTE

2. — — Sudarshan, P. : On a method of classifying regions from multivariate data (as in 1 above).
3. Sudarshan, P. : A note on inter-temporal differentials in Andhra Pradesh's development (as in 1 above).
4. Suryanarayana, M. H. & Iyengar, N. S. (1982) : On public services in national consumption : Some conceptual issues and suggestions, presented at a *Seminar of the Indian Association for Research in National Income and Wealth, Kodaikanal, October 6-8.*
5. Iyengar, N. S. & Harish, S. (1982) : On modified LIML estimators, presented at the *21st Annual Conference of the Indian Econometric Society, Anusmalainagar, January 10-12.*
6. Suryanarayana, M. H. : Treatment of poverty in the Sixth Plan. (as in 5 above).

### 5. Sociology

1. Bandyopadhyay S. (1983) : *Statistics in Social Anthropology*, submitted to the *70th Congress of Indian Science Congress Association, Tirupati, January.*
2. — — : How do rural community health programmes undermine health of rural community, seminar on, *The Role of Behavioural Sciences in Community Medicine With Special Reference to the Weaker Sections of the Society, Organised by All India Institute of Hygiene & Public Health, Calcutta and Indian Council of Social Science Research, New Delhi, 22-24 February 1983 at Calcutta.*
3. Biswas, S. K. and Chakraborty, Indrani (1983) : Old age health care in Bangali family, Seminar on, *The Role of Behavioural Sciences in Community Medicine With Special Reference to the Weaker Sections of the Society, Organised by, All India Institute of Hygiene & Public Health, Calcutta and Indian Council of Social Science Research, New Delhi, 22-24, February at Calcutta.*
4. Chakrabarti, Aniruddha (1982) : Accumulation process of economic and political supremacy of Brahman : A case study in Palamau District, Bihar, *8th Annual Conference of Indian Anthropological Society, 26-27 June, Calcutta.*
5. Ghosh, Bhole Nath (1982) : From cooperation to competition : Changing pattern in West Bengal village, *8th Annual Conference of Indian Anthropological Society, 26-27 June, Calcutta.*
6. Mookherjee, Shyamal (1982) : Variation in occupation mobility—experience in a village of Nadia, *8th Annual Conference of Indian Anthropological Society, 26-27 June, Calcutta.*

FIFTYFIRST ANNUAL REPORT : 1982-83

7. Mukherji, Partha Nath (1983) : Agrarian mobilisation and social change Gandhian and left perspectives, *National Seminar on Theory and Concepts*, Feb-March, Poona.

F. Statistical Quality Control

1. Buche, V. V. (1982) : QC Circles, presented in the one day seminar on QC Circles, organised by IAQC, Pune and Institute of Standards Engineers, Pune Chapter on 9 December.
2. Rao, Y. R. & Ranga Rao, N. T. V. (1982) : On some practical hints on use of OA tables in industrial experimentation, presented at the 3rd National Convention on Quality & Reliability held in Hyderabad from 29 to 31 December.
3. --- (1982) : On Measures of inspection accuracy, presented at the 3rd National Convention on Quality & Reliability held in Hyderabad from 29 to 31 December.
4. Venkatappaiah, J. (1982) : Some industrial applications of probability charts presented at the 3rd National Convention on Quality & Reliability held in Hyderabad from 29 to 31 December.
5. Dale, K. M. and Mohan Ranganathan, P. K. (1982) : Optimisation of Foundry Production through SQC, presented at the 3rd National Convention on Quality & Reliability held in Hyderabad from 29 to 31 December.
6. Ranga Rao, N. T. V., Kannan, C., Jha, B. N., and Govindaraju, N. (1982) : Improvement of Foundry Productivity through time Series Analysis, presented at the 3rd National Convention on Quality & Reliability held in Hyderabad from 29 to 31 December.
7. Ranga Rao, N. T. V., Kannan, C., Shankara Rao, T. and Jha, B. N. : Control of Tensile Strength of GI Test Bars, presented at the 3rd National Convention on Quality & Reliability held in Hyderabad from 29 to 31 December.
8. Arthanari, T. S. (1982) : The Travelling Salesman Problem, presented at the XI International Symposium on Mathematical Programming held in Bonn, West Germany during 23-27 August.
9. Basu, P. K. (1982) : Improvement of Productivity in a CFR manufacturing unit through application of Quality tools and techniques, presented at 3rd National Convention on Quality & Reliability organised by IAQR during 29 to 31 December. at Hyderabad .
10. Setty, C. A. (1982) : Quality & Profit-Definition of Quality, presented in the Seminar on Profitability through Quality Management in Small Scale Industries, organised by the Rotary Club of Bangalore during May.



## INDIAN STATISTICAL INSTITUTE

11. Pal, D. K. (1982) : Plant-wide Experimentation for Yield Improvement, presented in the *International Symposium on Ceramics organised by Electroporcelains Division of BHEL during November.*
12. Anand, K. N. (1983) : Studies of the effect of Composition on the Grade of Grey Cast Iron, presented at the *32nd Annual Convention of the Institute of Indian Foundrymen held in Madras during February.*

### F. Documentation Research and Training Centre

1. Bhattacharyya, G. (1982) : Design consideration of an information storage and retrieval system. (Paper presented at the *Summer School for Polytechnic teachers in Library Science. Bangalore, 24 May — 6 June.*)
2. ——— (1982) : Structure and development of information science. (Paper presented at the *Summer School for Polytechnic teachers in Library Science. Bangalore 24 May to 6 June.*)
3. ——— (1982) : Evolution of subject indexing languages. (Paper presented at the *Summer School for Polytechnic teachers in Library Science. Bangalore 24 May to 6 June.*)
4. ——— (1982) : *Classurus* : Its fundamentals, design and use. (Paper presented at the *International Study Conference on Classification Research — IV, Augsburg, West Germany. 28 June to 2 July 1982. Published in its proceedings volume 1, p. 139-148.*)
5. ——— (1982) : Librarianship in India and Ranganathan. (Paper presented at the *Seminar on Ranganathan's contributions to Library and Information Science, Bangalore. 2 August.*)
6. ——— (1982) : Current trends in classification research. (Paper presented at the *seminar on the theme classification research : International Scene. DRTC, Bangalore, 3 September.*)
7. ——— (1982) : Information manpower development system. (Paper presented at the *Seminar on Information manpower development. DRTC, Bangalore, 22 September.*)
8. ——— (1983) : Characteristic features of POPSI-Specific. (with D. Chandran). (*DRTC Annual Seminar, 20, Paper DC.*)
9. ——— (1982) : Information storage and retrieval (*All India Refresher Course on Trends in Information Retrieval. University of Mysore, Mysore, 6-26 December.*)

FIFTYFIRST ANNUAL REPORT : 1982-83

10. Bhattacharyya, G. (1982) : Postulato Base permuted Subject Indexing (POPSI) : Theory and practice. (*All India Refresher Course on Trends in Information Retrieval, University of Mysore, Mysore, 6-26 December*).
11. ——— (1982) : Standardization of bibliographic description for micro documents. (*All India Refresher Course on Trends in Information Retrieval, held at the University of Mysore, Mysore, 6-26 December*).
12. Gopinath, M. A. (1982) : Application of forecasting techniques for Library management. (Paper presented at the *Seminar on Library Management at the Indian Institute of Management on 25, 27 May*).
13. ——— (1982) : Applications of general systems theory to the classification theory of Ranganathan. (*International Study Conference on Classification Research (4) (Augsburg) (West Germany) 28 June --- 2 July, 1, 78-86*).
14. ——— (1982) : Bibliographic Classification in its new version. (Paper presented to the *Seminar on current trends in Information Retrieval under the auspices of the Indian Society for Technical Education and Polytechnic for Women during 24 May to 6 June*).
15. ——— (1982) : Intellectual organisation of information. (Paper presented at the *Seminar on Ranganathan's contributions to Library and Information Science. 12 August*).
16. ——— (1982) : New developments in Colon Classification. (Paper presented to the *Seminar on Current Trends in Information Retrieval organised by the Indian Society for Technical Education and Polytechnic for Women 24 May to 6 June*).
17. ——— (1982) : The Universal Bibliographical Control : Its prospects (Paper presented to the *Seminar on Current trends in Information Retrieval organised by the Indian Society for Technical Education and Polytechnic for Women, Bangalore during 24 May to 6 June*).
18. ——— (1982) : An analysis of the problems in the recognition of the manifestation of fundamental categories in the inter-disciplinary subjects. (*Ph. D. Thesis Submitted to Karnataka University, Department of Library and Information Science, Dharwar*).
19. ——— (1983) : A checklist of component ideas for classification. (*DRTC Annual Seminar. 20, Paper CB*).
20. Gopinath, M. A. (1983) : Development of interrelations of biology with other subjects. (with B. K. Chakraborty). (*DRTC Annual Seminar, 20, Paper BB*).
21. ——— (1983) : Development of typology of characteristics for speciators of facts in CC. (*DRTC Annual Seminar, 20, Paper CA*).

## INDIAN STATISTICAL INSTITUTE

22. ——— (1983) : Equivalence relations in information retrieval. (with Hemalata Iyer). (*DRTC Annual Seminar*, 20 ; Paper DE).
23. ——— (1983) : Facet analysis of compound subjects in biology and agriculture. (with H. S. Chakravarty and B. Ramadevi). (*DRTC Annual Seminar*, 20 ; Paper BE).
24. ——— (1983) : Study of complex subjects associated with mathematics (with A. Lakshmanamoorthy). (*DRTC Annual Seminar*, 20 ; Paper BD).
25. ——— (1983) : Study of complex subjects in natural sciences and social sciences. (with Inder Mohan, Krishnamani Bhandari and Sheik Saifulla). (*DRTC Annual Seminar* 20 ; Paper BF).
26. ——— (1983) : Study of compound subjects in physics. (with Ajith Kumar). (*DRTC Annual Seminar*. 20 ; Paper BC).

### 5. 4 BOOKS PUBLISHED

#### A. Theoretical Statistics and Mathematics

1. Natarajan, S. (1982) : *An Exposition of Ornstein's Isomorphism Theorem*. ISI Lecture Notes, No. 41, Macmillan (India) Limited, Delhi July 94 pages.

#### B. Physical and Earth Sciences

##### 1. Physics.

1. Gupta, A. B. (1983) : *Studies on the Mechanical Properties of Human Biomaterials*. Book Home, 31 College Row, Calcutta pp. 100.

#### C. Biological Sciences

##### 1. Anthropometry and Human Genetics

1. Malhotra, K. C. (with Misra, P. K.) (1982) : *Nomads in India*. Director, Anthropological Survey of India, pp. i-viii + 1-332.
2. Malhotra, K. C. (with Gadgil, M.) (1982) : *People's view of Eco-development*. Department of Environment, Government of India and the World Wide Life Fund-India, New Delhi, 1-26.
3. Malhotra, K. C. (with Abdusheligh, M. G. villi) (1982) : *New materials on the Anthropology of Western India*. Academy of Sciences of USSR, Moscow, 1-312.

FIFTYFIRST ANNUAL REPORT : 1982-83

D. Social Sciences

1. Demography

*Proceedings of Population Control Planning Seminar*, (1982) Demography Research Unit, Indian Statistical Institute, Calcutta.

2. Per-Census Population Studies

1. Bhattacharya, Durgaprasad (1982) : ed. *Report on the Population Estimates of India*. III, 1811-1820. Eastern Region, New Delhi. Office of the Registrar General, India. X L, 331p.

3. Sociology

1. Chatterji, Bhola : *Portrait of a Revolution : B. P. Koirala*. New Delhi, Ankur Publishing House.
2. Mukherjee, Partha Nath (1983) : *From Left Extremism to Electoral Politics*, New Delhi, Manohar Publishers, (in press).

E. Documentation Research and Training Centre

1. Bhattacharyya (with Gopinath, M. A.) (1983) : *Classification and Indexing in science and technology* : The working document prepared for the DRTC Annual Seminar 1983 Bangalore, DRTC. Indian Statistical Institute, 413p.

5.5 ARTICLES PUBLISHED IN BOOKS

A. Physical and Earth Sciences

1. Electronics and Communication Science

1. Choudhuri, B. B. and Dutta Majumder, D. (1982) : *On Membership evaluation in Fuzzy sets, in Fuzzy information and decision process*—M. M. Gupta and Sanchez eds North-Holland Publishing, Amsterdam, Netherlands, (p. 3-11).
2. Pal, S. K. : *Fuzzy set theoretic Approach—Tool for speech and Image recognition, in Pattern Recognition Theory and application* J. Kittler, K.S.F.U., L. F. PAU eds, NATO Advanced study Institute series-C Mathematical and Physical Science, C8 I, (p. 103-117), D. Reidel Publishing Company, 3300 AA Dordrecht, Holland.
3. Chowdhury, B. B. : *Membership Evaluation in Encyclopedia of systems and Control*, Pergamon Press, U. K.—eds M. M. Gupta etc. (in press).

## INDIAN STATISTICAL INSTITUTE

### B. Biological Sciences

#### 1. Anthropometry and Human Genetics

1. Basu, A., Gupta, R., Mitra, P., Dewanji, A. and Sinha, A. (1982) : Variations in resting blood pressures among Sherpas of the eastern Himalaya (presented at the *ISI Golden Jubilee Conference on Human Genetics and Adaptation, Calcutta, 1-5 February*).
  2. Basu, A., Gupta, R. and Mukhopadhyay, B. (1983) : Anthropological demography of populations of the eastern Himalaya, In : J. R. Lukacs (ed.), *Peoples of South Asia*, Plenum Press, New York.
  3. Majumder, P. P., Mitra, P., Bhattacharya, S. K. and Basu, A. (1982) : Pterygium : Likelihood analysis of four Sherpa pedigrees (presented at the *ISI Golden Jubilee Conference on Human Genetics and Adaptation, Calcutta, 1-5 February*).
- Following chapters were written in the book titled "*New material on the Anthropology of the Western India*" published by Institute of Ethnography, Soviet Academy of Sciences, USSR, in Russian language, 1982.
4. Mukherjee, B. N., Malhotra, K. C. and Kate, S. L. : *Colour Blindness among populations of Delhi, Maharashtra and W. Bengal and selection relaxation hypothesis.* 263-270.
  5. --- *Phenyl Theocarbamide sensitivity amongst 13 endogamous groups of Maharashtra.* 271-278.
  6. Kate, S. L., Malhotra, K. C., Mukherjee, B. N., Mutalik, G. S., Sainani, G. S. and Phadke, M. A. : *Haemoglobin variation and glucose-6 phosphate dehydrogenase deficiency among 10 groups of Maharashtra and W. Bengal.* 279-281.
  7. Mukherjee, B. N., Malhotra, K. C., Das, S. K., Majumdar, P. P., Roy, M., Kate, S. L. and Sainani, G. S. : *Genetic polymorphism amongst nine endogamous groups of Maharashtra.* 282-296.
  8. Mukherjee, B. N., Majumdar, P. P., Malhotra, K. C., Das, S. K., Kate, S. L. and Chakraborty, R. : *Analysis of genetic distances between nine endogamous groups of Maharashtra.* 297-300.
  9. Malhotra, K. C. (1982) : Palmar hypothenar triradii in man : some methodological and evolutionary considerations. In *Progress in Dermatoglyphic Research.* C. S. Bartsocas (ed.), Alan R. Liss Inc., NY, 203-247.
  10. --- (with Karmakar, B. and Vijayakumar, M.) (1982) : Progress in genetics of palmar pattern ridge counts in man : In *Progress in Dermatoglyphic Research.* C. S. Bartsocas (ed.), Alan R. Liss Inc. NY, 111-128.

FIFTYFIRST ANNUAL REPORT : 1982-83

11. ——— (with Gadgil, M.) (1982) : Questioning the Bedhi Hydel Project : an experiment in peoples participation. In *Proc. Conf. on Non-Governmental Organizations working on environmental protection*. World Wildlife Fond, India. New Delhi, 81-85.
12. ——— (1982) : *Section on nomads in India's Environment* (1982) : Center for Science and Environment, New Delhi, 181-183.
13. ——— (with Samerakhody, A.) (1982) : Demographic Analysis of a non-pastoral nomadic group in Maharashtra. In *Nomads in India*, P. K. Misra and K. C. Malhotra (eds), Anthropological Survey of India, 23-41.
14. Malhotra, K. C. (with Khomne, S. B.) (1982) : Social stratification and caste ranking among the Nandiwallas of Maharashtra. In *Nomads in India*. P. K. Misra and K. C. Malhotra (eds), Anthropological Survey of India, 75-92.
15. ——— (with Hulbe, S. K. and Khomne, S. B.) (1982) : Economic organization of the nomadic Nandiwallas and Deowallas of Maharashtra. In *Nomads in India*. P. K. Misra and K. C. Malhotra (eds), Anthropological Survey of India 104-130.
16. ——— (with Thambidorsai, G. V. K.) (1982) : The dieties of Nandiwallas. In *Nomads in India*. P. K. Misra and K. C. Malhotra (eds), 131-139.
17. ——— (with Khotane, S. B. and Hulbe, S. K.) (1982) : Communicants of greater tradition : the nomadic Nandiwallas of Maharashtra. In *Nomads in India*. P. K. Misra, and K. C. Malhotras (eds), 195-201.
18. ——— (with Chakravarti, R., Bhanu, B. V. and Fulmali, P. M.) (1982) : Quantitative analysis of the finger prints of 9 population groups of West India. In *New Materials on the Anthropology of Western India*. M. G. Abdushelishvilli and K. C. Malhotra (eds), Academy of Sciences of USSR, Moscow, 205-248.
19. ——— (with Chakravorty, R. and Tateno, Y.) (1982) : Variation in dermal ridges in 9 populations groups from Maharashtra. In *New Materials on the Anthropology of Western India*. M. G. Abdushelishvilli and K. C. Malhotra (eds), Academy of Sciences of USSR, Moscow, 254-262.
20. ——— (with Mukherjee, B. N. and Kate, S. L.) (1982) : Incidence of red-green colourblindness in populations of Delhi, Maharashtra and West Bengal. In *New materials on the Anthropology of Western India*. M. G. Abdushelishvilli and K. C. Malhotra (eds) Academy of Sciences of USSR, Moscow, 263-270.
21. ——— (with Kate, S. L. and Mukherjee, B. N.) (1982) : Variation in PTC Taste Threshold among 13 endogamous castes and tribes of Maharashtra. In *New Materials on the Anthropology of Western India*. M. G. Abdushelishvilli and K. C. Malhotra (eds), Academy of Sciences of USSR, Moscow, 271-278.

## INDIAN STATISTICAL INSTITUTE

22. ——— (with Kala, S. L., Mukherjee, B. N., Mutalik, G. S. and Phadke, M. A.) (1982) : Variation in G-6-PD and Hb types among ten endogamous groups of Maharashtra and W. Bengal. In *New Materials on the Anthropology of Western India*. Academy of Sciences of USSR, Moscow, 279-281.
23. Malhotra, K. C. (with Mukherjee, B. N., Das, S. K., Majumdar, P. P., Roy, M., Kala, S. L. and Sainani, G. S.) (1982) : Genetic polymorphism among nine endogamous groups of Maharashtra. In *New Materials on the Anthropology of Western India*. Academy of Sciences of USSR, Moscow, 282-296.
24. — (with Mukherjee, B. N., Majumdar, P. P., Das, S. K., Kala, S. L. & Chakraborty, R.) (1982) : Distance analysis among nine endogamous groups of Maharashtra. In *New Materials on the Anthropology of Western India*. Academy of Sciences of USSR, Moscow, 297-300.

### C. Statistical Quality Control and Operations Research

1. Iyer, V. Narayana of the SQC Unit, Trivandrum (1982) : Economic Package Size in Spinning, *Indian Textile Journal*, September, 10, 1982 issue 85-95.
2. — Director of Indian Standards Institution, Kerala (1982) : Problems of Small Scale Industries, QR Views, *Quarterly publication of Indian Association for Quality & Reliability, Trivandrum Branch*, September Issue.
3. Ananta Rao, C. R. of the SQC Unit, Bangalore (1982) : Achieving More Uniform Drawing Sliver in a Spinning Mill Through Beta Adjustment Factor Techniques, *QR Journal*, September Issue.
4. Roychowdhury, A. of the SQC Unit, Bangalore (1982) : Replacing Destructive by Non-Destructive Testing : *QR Journal*, September.
5. Anand, K. N. of the SQC Unit, Bangalore (1983) : Development of Optimum Process conditions in a Chemical Plant producing Paraffin Wax, *QR Journal*, January.
6. Perumallu, P. K. of the SQC Unit, Bangalore (1983) : Optimum of Parameters for Electron Beam Welds Process, *QR Journal*, January.

## 5.6 TECHNICAL REPORTS

### A. Applied Statistics, Surveys & Computing

1. Adhikari, Arun K. : On randomised response surveys with sensitive quantitative characters : A Case Study in I.S.I. *Technical Report No. ASC/83/6*.

## FIFTYFIRST ANNUAL REPORT : 1982-83

2. Mukherjee, A. C. and Mukhopadhyay, S. : Construction of Balanced Incomplete Youden hyper rectangles.
3. Mukherjee, A. C. & Saha, R. : Repeated Measurement Design.
4. Mukherjee, B. N. & De, Jatin : A study of social and political institutions of three settlements in Ranaghat block—II, Council for Social Development, New Delhi.

### B. Biological Sciences

#### 1. Anthropometry and Human Genetics

1. Bhattacharya, S. K., Bharati, P., Mukhopadhyay, B. and Maitra, N. (1982) : Intestinal parasitic prevalences in relation to economic status in a villages population of Howrah district, West Bengal. *ISI Tech. Report No. Biochem/4/82*.
2. Bhattacharya, S. K., Datta, S., Das, S. K., Gupta, R., Roy, D. and Basu, A. (1982) : Variations in differential leukocyte count in relation to age and body build in a rural population of West Bengal, India. (Presented at the Annual Conference of the Indian Society of Haematology and Blood Transfusion, Calcutta, December, 1981) *ISI Tech Report No. Anthropol/6/81*.
3. Roy, S. K. & Bharati, P. (1982) : Selection intensity : inter and intra-group variations. *ISI Tech. Report No. Anthropol/5/82*.
4. Pakrasi, Kanli (1983) : Control of Expanding Family : Indian Experiences (cyclostyled), p. 1-15.

#### 2. Biochemistry

1. Bhattacharya, S. K., Bharati, P., Mukhopadhyay, B. and Maitra, N. (1982) : Intestinal parasite prevalences in relation to economic status in a village population of Howrah District, West Bengal, ISI, Tech, Report No. Biochem/1/82 (revised version of a paper presented at the *International Symposium on Problems of Development of Underprivileged Communities in the Third World Countries, New Delhi, October*).
2. Rupta, R., Das, S. K., and Bhattacharya, S. K. : Altitude and Haematology among the Sherpas and the Lepchas of the Eastern Himalay, *ISI Tech Report No. Anthropol/1/83*.

### C. Social Sciences

#### 1. Demography

1. Sarkar, B. N. : Sterilization Acceptance in Rural Areas Away from Calcutta (DRU Publication Number 36).



## INDIAN STATISTICAL INSTITUTE

2. —(1982) : Experiences of Field Visits in Sample Village of Maldah and West Dinajpur, (DRU Publication Number 37).
3. Raman, M. V. : Change in Female Work Participation after Marriage and Husband-Wife Occupational Correspondence in Calcutta (DRU Publication Number 38).
4. Neogi, Indrani : Literacy Development Among Female in Family Life in Rural Areas of Maldah and West Dinajpur (DRU Publication Number 39).
5. Sarkar, B. N. : Occupation Mobility in Rural Areas Around Calcutta (DRU Publication Number 40).
6. — : Disparities in Inter State Consumer Expenditure (1957-58 to 1973-74) (DRU Publication Number 42).
7. Saha, A. K. : Availability of Family Welfare Service of the Rural Population of Bengal (DRU Publication Number 41).

### 2. *Economic Research*

1. Coondoo, D. & Majumdar, Amita (1982) : A system of Demand Equations based on price independent generalised linearity, 3rd May
2. Coondoo, D. (1982) : Two point aggregation of consumers demand, 1st June
3. Sarkar, Nityananda (1982) : Consistency and asymptote normality of the M4 estimator of limited dependent variable models with heteroscedasticity. 21st June
4. — 1982 : A study of the Box-Cox model with Heteroscedasticity non-normality. 30th August
5. — (1982) : Estimation and testing in an autocorrelated linear regression model with decomposed error term : The case of two AR(1) components, 2nd September
6. Bhawmik, Mrinal & Pal, Monoranjan (1982) : Grouping and rank estimators in EVMS. 22nd September
7. Coondo, D. & Majumdar, Amita 1982 : Performance of the linear expenditure system and its modifications with non-linear price functions on Indian data. 22nd October
8. Bhattacharya, B. (1982) : Asymptotic properties of least squares estimators of a varying parameter autoregressive process. 8th November
9. Bandyopadhyay, Dabdas (1982) : Product Mix in the output. 26th November

FIFTYFIRST ANNUAL REPORT : 1982-83

10. De, R.N. & Majumdar, K.C. (1983): A consistent framework for regional allocation of gross cultivable area under different crops : A case study for the sixth plan. 12th January
11. Malli, P. (1983) : India's inputs during the last three decades. 31st January
12. Majumdar, K. C. & Panda, M. K. (1983) : A comparative study of sixth and fifth plan models. 1st April
13. Pal, Monoranjan (1982) : Some observation on identification in EVM's. 6th July
14. Majumdar, K. C. & Chakraborty, Suigitha (1982) : Growth and financial resources in sixth plan period—An appyaisal. 8th October

3. *Economic Analysis Unit*

Technical comments on the official Note prepared by Central Statistical Organisation for consideration of the Working Group to Evolve a New Methodology for Identification of the Poor. (Refer our No. EA/316 dated 24 November 1982, mimeo).

4. *Sociology*

1. Bandyopadhyay, Suraj : From observation to inference : some fallacies of interpretation in sociological survey research, 19 pages cyclostyled.
2. — : Where are the freed bonded agricultural labourers gone? 8 pages, cyclostyled.
3. — (with Donald Von Eschen) : An extended summary of the conditions of rural progress in India, 89 pages, cyclostyled.

D. *Statistical Quality Control*

(i) *Technical Reports*

1. Majumdar, A. : Simple formulae for AOQL calculation for single sampling plan.
2. Rao, Y. R. : Case Study on acceptance procedure for high pressure turbine moving blades at final inspection stage.
3. Sapat, M. N. : Setting Optimum Process Parameters for varnish impregnation of traction armature by vacuum process.
4. — : To Improve Determination of Natural frequency of vibration of Hydro-generator Fan Blades.

## INDIAN STATISTICAL INSTITUTE

### (ii) *Manual/Note*

1. Course manual on In-plant training course on SQC at M/s. TELCO, Pune.
2. Course manual on In-plant training course on SQC at M/s. Amphetronix Ltd., Pune.
3. Course manual on OA Experimentation Course held in May 1982.
4. Course manual on OA Experimentation Course held in February, 1983.
5. Note on SQC Discipline for the Production Management Course for the Managers of Kerala State Electronics Development Corporation on 22 October 1982.
6. Note on the Seminar presented by the Tata Consultancy on Price and Demand Fluctuation of Yarn on 19 October 1982 by V. Narayana Iyer.
7. Course manual on Orientation Programme on total Quality Control for the course organised for Kirloskar Bros. Ltd., Corporate office at Pune during 14 & 15 March 1983.
8. Course manual on Quality Assurance System for one day programme for Senior officials from Socialist Republic of Vietnam on behalf of National Test House, Calcutta.
9. Course note on Quality Circle for the supervisory training programme at Tribeni Tissue Ltd.

### Part II. Convocation, Visiting Scientists, Honours and Awards, Scientific Tours and Assignment.

#### 6. *Seventeenth Convocation*

The Seventeenth Convocation of the Indian Statistical Institute, held on 28 February 1983, was presided over by Shri Subimal Dutt, President of the Institute. Professor Sukhamoy Chakravarty of Delhi School of Economics, Delhi, delivered the Convocation Address on "Mahalanobis and Contemporary Indian Planning". Dr. B. P. Adhikari, Director of the Institute, presented the annual review of research, teaching and training.

The number of candidates awarded Ph. D., M. Stat. and B. Stat. (Hons.) Degrees, Statistician's Diploma and Post-Graduate Diplomas in Applied Statistics and Certificates