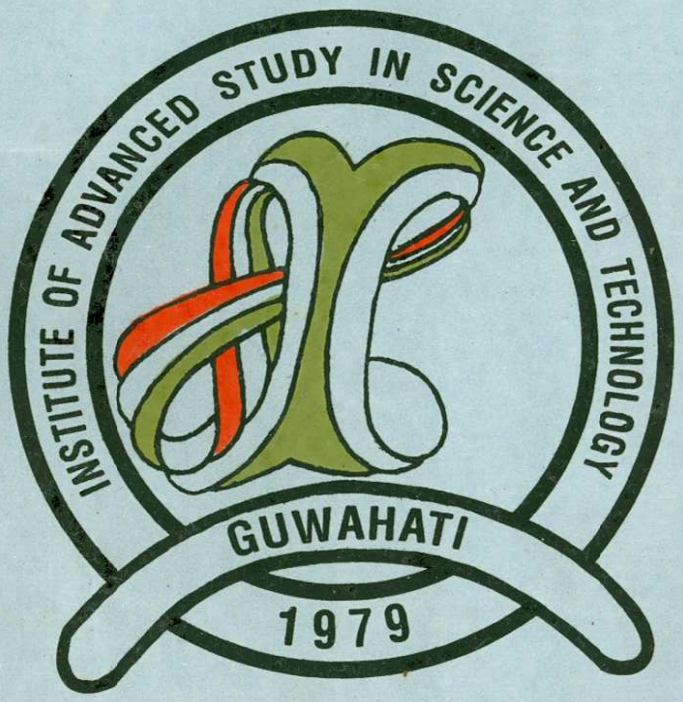
ANNUAL REPORT

APRIL, 1996 - MARCH, 1997



INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
KHANAPARA, GUWAHATI - 781 022
ASSAM (INDIA)

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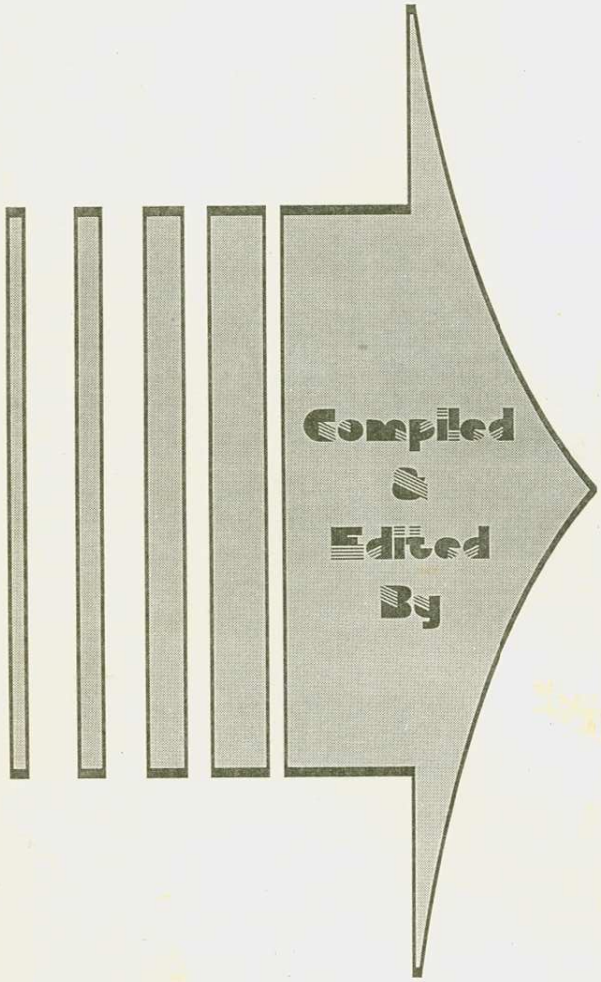

Professor K. C. Barua
Director, IASST

Dr. M. K. Kalita
Administrative Officer &
Secretary (i/c), IASST

Professor A. K. Agarwal
Head, Mathematics &
Statistics Division

Dr. Joyanti Chutia
In-Charge,
Plasma Physics Division

Dr. P. Azad
In-Charge,
Life Sciences Division

Dr. S. Deka
In-Charge, Resource
Management &
Environment Division

Mr. B. Bora
In-Charge,
Computer Science Division

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FOREWORD

The IASST was established by the Assam Science Society in the year 1979 and was registered as an independent institute in 1991, under Societies Registration Act. The development of the IASST was envisaged in the Assam Accord (clause 7B). The Govt. of Assam has provided a plot of land measuring 20 acres in Pashim Boragaon in greater Guwahati and also a regular maintenance grant since the year 1991-92.

The Research and Development activities of the IASST, during the period April'96 to March' 97, have been presented in brief in this Annual Report.

The Department of Science and technology, Govt. of India has sponsored two major projects viz. "Development of Mathematical and Statistical Sciences Division, IASST" and "Development of Plasma Physics Division, IASST". Every efforts have been made to utilise this opportunity in strengthening these two divisions, so that, the IASST could carry out high standard research in the fundamental Sciences and train young researchers in the challenging areas.

The Life Sciences Division has takin up important projects like Development of Bio-fertilizer, Indoor rearing of Muga Silkworm, Chemical Analysis of Traditional Herbal Medicines etc. The first project was sponsored by the Department of Bio-technology, Govt. of India and the last two were sponsored by the Department of Science & Technology, Govt. of India. Another Project on "Phytopathogenic fungi" was sponsored by the ASTEC, Govt. of Assam.

The resource Management & Environment with on the research activities in the North Eastern region on Resource Management and Environment with a seed money provided by the ministry of Environment and Forest, Govt. of India. Another project, on the control of hydrocarbonaceous pollution, sponsored by the DST, Govt. of India is in progress.

The S&T Manpower Study Cell has been actively engaged in a DST, Govt. of India Sponsored project on utilisation and career profile of post graduate and Ph.D's in S&T in the higher educational institutions in the NE region.

We are very much thankful to the DST, DBT, Ministry of Environment & Forests Govt. of India and DST, Govt. of Assam for financial support to the above mentioned projects.

Our special thanks go to Dr. Y. Nakamura, Scientist, Institute of Space & Astronautical

Science, Japan for providing training to Dr. H. Bailung in his institute at Japan and alsofor visiting the IASST for about 20 days interacting with the exprimental Plasma Physics group of the institute. I also thank Dr. S.G Tagare, Professor of Mathematics, Hyderabad University for spending about three months time and interacting with the scientists of the IASST. I wish to thank the Chinese Academy of Sciences, Beijing for proving a fellowship and training for 3 months to Sri A. Sarma, J.R.F., in the Plasma Physics Division and also for donating some equipments to Plasma Physics division of the IASST.

I shall fail in my duties if I do not Thank all the acacemic and non-academic ataff of the IASST, for their full co-operation and devotion to work, without which it would not have been possible to complete an eventful year of the IASST.

Prof. K.C. Barua
Director

CONTENTS

Collection of Soil Samples from oil field situated at Moran (OCS-1) to study the impact of oil exploration on soil quantity

Dr. Y. Nakamura, Institute of Space & Astraunatical Science, Tokyo planting a sapling

COUNCIL OF THE INSTITUTE
(April 1996 - March 1997)

1.	Prof. D. Chaliha Former vice-Chancellor AAU, Jorhat	Chairman
2.	Prof. K. C. Barua Director, IASST	Member
3.	Prof. A. K. Goswami President, Assam Science Society	-do-
4.	Prof. H. L. Duorah Prof. of Physics, G.U.	-do-
5.	Dr. A. C. Ghosh Director, RRL, Jorhat	-do-
6.	Dr. D. N. Borthakur Former Vice-Chancellor AAU (Co-opted)	-do-
7.	Dr. K. C. Barua Director, Forensic Science Laboratory, Shillong, Magahalaya (Co-opted)	-do-
8.	Prof. D. T. Khathing Prof & Head, RSIC NEHU, Shillong	-do-
9.	Prof. P.C. Deka Prof & Head, Deptt. of Biotechnology, AAU, Jorhat	-do-
10.	Prof. K. C. Deka Director, ASTEC, Guwahati	Member
11.	Dr. G. K. D. Majumdar USIC, G.U. (Representative of the Assam Science Society)	-do-
12.	Dr. A. K. Bhagabaty General Secretary Assam Science Society	-do-

13. Dr. P. Azad
Assistant Professor
IASST -do-

14. Secretary
Depertment of Science, Technology
& Environment, Govt. of Assam, Dispur -do-

15. Secretary, Department of Educaton,
Govt. of Assam,Dispur. -do-

16. Director,
Technical Education, Govt. of Assam,
Kahilipara. -do-

17. Dr. Bikash Sinha, Director, VECC
Calcutta (Representative of DAE, GOI) -do-

18. Dr. A. K. Chakraborty, Adviser, DST,
Govt. of India (representative, DST, GOI) -do-

19. Representative, CSIR, Govt. of India. -do-

20. Representative, UGC. -do-

21. Dr. M.K. Kalita, Secretary (i/c), IASST. -do-

STAFF OF THE IASST

Professor K. C. Barua — Director

Plasma Physics Division:

1. Dr. Joyanti Chutia — Associate Professor

2. Dr. G.C. Das — Associate Professor

3. Dr. C.B. Dwivedi — Assistant Professor

4. Dr. H. Bailung — Assistant Professor

Research Scholars:

1. Sri Arun Kr. Sarma	JRF
2. Sri Jnanajyoti Sarma	Part-time Research Scholar
3. Sri Santanu Baishya	-do-
4. Ms. Madhuri Talukdar	-do-

Mathematical Sciences:

1. Prof. J. Medhi	Hon. Professor
2. Prof. A. K. Agarwal	Professor
3. Dr. K.K. Das	Assistant Professor
4. Dr. (Mrs.) M.R. Agarwal	Assistant Professor
5. Sri D. N. Das	Chief Statistician

Research Scholars:

1. Ms. Barnali Dutta	JRF
2. Ms. Sangeeta Kalita	JRF

Resource Management & Environment Division :

1. Dr. S. Deka	Assistant Professor
2. Ms. Arundhati Devi	Senior Research Assistant

Life Sciences Division :

1. Dr. J.N. Talukdar	Hon.Professor
2. Dr. P. Azad	Assistant Professor

3. Dr. J. Kotoky	Assistant Professor
4. Dr. (Mrs.) D. Devi	Assistant Professor

Computer Science Division :

1. Sri A. Barman	Assistant Professor
2. Sri B. Bora	Assistant Professor
3. Sri L.B. Mahanta	Assistant Professor
4. Sri N. Bhagobaty	Sr. Instructor
5. Ms. Madhuri Talukdar	Instructor
6. Sri Bubu Bhuyan	Instructor

Administration:

1. Dr. M.K. Kalita	Admn. Officer & Secretary i/c
2. Md. A. Mazid	F.A.O.
3. Sri R. Sarma	P.R.O.
4. Sri P.K. Deka	U.D.A.
5. Sri S. Sarma	Accountant
6. Sri R. Mahanta	LDA
7. Mrs. S. Bora	LDA
8. Sri R. Kalita	LDA
9. Sri D. Deka	LDA
10. Sri K.Baishya	Library Assistant

11. Sri N. Hazam	Driver
12. Sri B. Deka	Messenger
13. Sri U. Deka	-do-
14. Sri S. Das	-do-

Supporting Staff :

1. Sri M. Singh	Console Operator Computer Science Division
2. Ms. J. Bordoloi	Laboratory Assistant Life Sciences Division
3. Sri S. Goswami	Laboratory Assistant Life Sciences Division
4. Krishna Kanta Swargiary	Mechanic Plasma Physics Division

Laboratory Helper/Watcher :

1. Sri T. Talukdar	Life Sciences Division
2. Sri G. Gupta	-do-
3. Sri B. Das	-do-
4. Sri Madan Kalita	R.M. & E.D.
5. Sri K. Deka	Plasma Physics
6. Sri Bipul Das	-do-
7. Sri N.Goswami	-do-
8. Sri A. Pathak	-do-
9. Sri H.Medhi	Choukidar

10. Sri L. Saud -do-

Visitors:

1. Dr. Y. Nakamura, Institute of Space & Astronautical Science, Tokyo, Japan visited Plasma Physics Division during the period, April - May, 1996.

2. Dr. S. G. Tagare, Department of Mathematics, University of Hyderabad, visited Mathematical Sciences Divesion during the period, Oct-Dec'96.

3. Prof. P.M. Neumann, Department of Mathematics, Queen's College, Oxford University, U.K.
4. Dr. R.G. Moller, Department of Mathematics University of Iceland, U.K.

RESEARCH AND DEVELOPMENT ACTIVITIES :

PLASMA PHYSICS DIVISION :

A. Experimental :

1. The instability excited by the ion-rich sheath in plasma is characterised by different parameters like plasma density, ion beam energy, sheath thickness, electric field in the sheath region etc. In a double plasma device the ion sheath is produced around a negatively biased grid placed between the two chambers. The sheath instability appears in the target chamber when an ion beam is injected to it from the source chamber by biasing its anode positively with respect to target of by maintaining a density difference between the two chambers. Our work is concerned with the instability excited by creating a density difference in the two chambers of the double plasma device. The excitation of instabilities at different plasma conditions such as different density ratio of the two chambers, different grid bias and source bias voltages. These parameters drastically change the potential profiles of the two chambers which modify the instability behaviour. If the density difference between the two chambers is slowly decreased the instabilities exhibit oppositely different characteristics after a critical value. Below the critical value of the density ratio, the energy resonance of the background ions and the beam ions is a typical condition for the excitation of such instabilities. Chaotic phenomena happen to occur when there is a hump in plasma potential profile near the sheath edge. Above the critical value of density ratio, the instability occurs due to the interaction of the three beams that arise due to asymmetry of the sheath potential.

The properties of a steady state ion rich sheath and sheath induced instability in multi component plasma with negative ions have also been studied. The study of sheath phenomena in negative ion plasma is getting importance in plasma processing, ion source, study of lower atmosphere and fusion research etc. The presence of negative ion in plasmas critically changes the plasma properties lice sheath thickness, particle dynamics, dispersion relation and beam interaction etc.

Introduction of SF_6 gas into the Argon plasma leads to the formation of several species of positive and negative ions such as Ar^+,F_5^+,$F_1^-$and SF_6^-. However, in the laboratory discharge conditions F is considered to be the primary species formed due to dissociative attachment process. The ratio of negative to positive ion concentration is taken from 0.2 to 0.6. The

production of the negative ions inhibit the motion of the positive ions due to the initial effect of the negative ions and as a result the shielding effect is reduced and the sheath thickness increases. The dependence of sheath thickness on different concentration ratio and biasing voltage of the grid and the source chamber has been observed. The measured drift velocity of the ions entering sheath increases with negative ion concentration. A low frequency instability is induced by the ion rich sheath when the ratio of velocities of the reflected ions and free fall ions fall in the range of $0.5<V_b/V_0<1$, where V_b is the beam velocity and 'V_0' the average velocity of reflected ions. In multicomponent plasma, there exists a point near the negatively biased grid at which the negative ions are reflected. The potential at this point becomes equal to kinetic energy of the drifting negative ions. Therefore, there exists a region with mostly of positive ions near the grid and few electrons toward the sheath edge. In this region, the positive ion current to the grid is space charge limited and given by the Child-Langmuir Law.

B. Theoretical :

(i) A fundamental contribution has been reported by the discovery of a new sound wave namely the So-called Acoustic Mode in multispecies plasmas. Such sound waves are more likely in plasmas containing dust like heavier impurities. It is emphasised that the distinction of such waves could be carried out by analysing the electrodynamical response of the plasma species. The existence of such sound wave has been demonstrated in laboratory dusty plasmas in 1995.

Recent observation of Coulomb Phase Transition (CPT) in correlated plasmas (normal dusty plasmas) in 1994 has become a current subject for theoretical and experimental plasma physicists. A new wave turbulence model has been proposed as a possible physical model for understanding the novel phenomenon of Coulomb phase transition. It is reported that the weak correlation effect comes into action due to linear turbulence and causes collective Coulomb condensation of the plasma particles. It compresses the pseudoparticles (solitary waves) with enhancement in its potential amplitude. According to the proposed model, thermodynamical behaviour of these pseudoprticles could govern the physics of CPT. However, future scope is there for suitable improvements of the proposed physical model for CPT.

Adequate attention has been given to evolve a collaborative research programme within and outside plasma physicists. Such collaborative activities are of interdisciplinary in nature within a broader framework of basic research in theoretical and experimental plasma physics. The main thrust of our group is to carry out fundamental research on plasma sheath and its stability behaviour under various conditions. In this field, a joint effort has been made to study the existence condition of the plasma sheath under external gravity effect. It is reported in addition to usual Bohm sheath criterion under weak gravity effect. Practical relevance theoretical analysis has been discussed in the context of spokes formation in planetary rings and laboratory phenomenon of Coulomb phase transition.

Applying the conceptual framework of plasma wave phenomena, a novel mode of self gravitational collapse of a partially ionised dust mass distribution has been reported. Accordingly, it is found that this novel mode of gravitational collapse, namely the Pulsational Mode of Gravitational Collapse (PMGC) may cause the pulsational mode of star births. This is more likely in dust clouds of the size of the order of the critical Jeans length.

Finally, again under the inter institutional collaborative programme, a possible theoretical model has been proposed to interpret the plasma disruption behaviour of a low-q ($q<3$) SINP tokamak. It is experimentally observed that the plasma disruption through current quenching is not always a single step phenomenon. Rather it may occur as a periodic event during current quenching phase of the plasma disruption. The proposed theoretical model which is based on the nonlinear hysteresis effect explains (at least qualitatively) the observed features of the periodic current quenching. Such events occur under specific conditions of external control parameters like filling pressure, loop voltage etc.

(ii) The study of wave propagation has attracted a good deal of interest among the researchers and by now has taken a pioneer position in plasma dynamics. The study on waves is used widely to advance the understanding of the basic properties in various physical problems in plasma physics, fluid dynamics and magnetohydrodynamics (MHD). Among them, the study on wave dynamics carried out all the way a prime interest in plasma dynamics and thereafter tried to bridge a closed relation between the theory and experiments. In the beginning, the linear theory has shown a threshold application to diagnise the plasma parameters theoretically. Later the observations have been proven in laboratory plasmas as well as confirmed the satellite observations on various wave modes and vice versa. Later, the plasma

dynamics stirred up to know the salient features of nonlinear waves in relation to the observations in laboratory as well as by the man made satellite observations in space plasmas. Based on the universal reductive perturbation technique, derived the nonlinear K-dV equation in simple plasma model to find the remarkable support to the experimentalists as well as to the satellite observations in space plasmas. A tremendous boosting has been taken up still now through the derivation of Plasma-acoustic solitary waves in multicomponent plasma especially when the plasma with additional negative ions, and has shown even now a new era in studying the solitions theoretically and experimentally.

Our motivation is aimed to study the basic phenomena of different solitary waves with a view to advancing the interest in understanding the salient features of solitons for the future plasma experiments and to support satellite observations in space as well. We first like to formulate systematically the problems to study the nonlinear wave dynamics. In this regards, we might like to show the effect of negative ions and multiple trapped electrons, which are found common in laboratory and space plasmas and would like to investigate through the nonlinear Kadomtsev-Petviashvili (K-P) equation to know the soliton dynamics in plasmas. The preliminary working process indicates that, because of the new technique employed by us the nonlinear K-P equation reduces to an ordinary differential equation and by which it can be solved analytically as well as by some other suitable methods and in the failure case a numerical method is like to be employed. In the case of failure in solving analytically, we nay expect in the plasma-acoustic wave dynamics, an alternate analytical method to be adopted. Again in order to study the solitary waves of arbitary amplitudes, we later like to employ the quasipotential analysis to derive the Sagdeev potential equation. From which, we, under small amplitude approximation, like to derive the well known K-dV or K-P equation and find to relate both the approaches.

Recently a new motivation has taken up to endeavour the researchers to disentangle the salient features of nonlinear waves in plasmas contaminated by the dust charge grains which are common in space and laboratory plasmas. The study of dusty plasma dynamics spurred many scientists. Next motivation is to know the soliton dynamics in dusty plasmas to investigate the dust acoustic waves which might be of interest for the future experiments in dusty plasmas.

A part of the work has been already under process out of which we established few new findings as well.

Visit of the Scientists to other Institutions :

i. Mr. Arun Sarma, visited the Institute of Physics, Chinese Academy of Sciences, Beijing under Asian African Association for Plasma Training fellowship for 3 (three) months with effect from 17th Sept' 96 and worked on ECR Plasmas System.

ii. Dr. H. Bailung, visited plasma laboratory of the Institute of Space and Astronautical Science, Japan for collaborative Research work on Dusty Plasma during Nov 1-Dec.28, 1996.

iii. Dr. Joyanti Chutia visited experimental Plasma Physics Division, Christian Albreicht University, Germany for one month with effect from 10th March'97 under Indo-German exchange programme.

iv. Dr. C.B. Dwivedi visited the Plasma Physics Group of SINP, Calcutta to carry out collaborative research work during May-June, 1996. During the visit, he delivered a talk on "Work Correlation effect in Plasmas" in Jadavpur University. Dr. Dwivedi also visited IPR, Gandhinagar, Gujarat during June-July, 1996 to carry our research work on Plasma Sheath.

Research Publications :

1. Characteristics of Sheath instability in Dp device. A. Sarma, H. Bailung & J. Chutia Phys. Plasma 4, (1) 1997, p61.

2. Small amplitude IA waves in Inhomogeneous Plasmas. G.C. Das and K.M. Sen. Ind. J., Pure 7 Appl. Phys. 34, 539, 1996.

3. Some aspects of solitary waves in a relativistic inhomogeneous Plasmas. G.C. Das, S. Duorah, S.S. Singh C. Uberoi Space Sci, 44, 485, 1996.

4. Propagation of various K-dV solitary waves in temperature electron plasma. G.C. Das, S.S.Singh, K.I.Singh Chaos, Solitons, Fractal 17, 309, 1996.

5. Is dust Acoustic wave a new plasma Acoustic mode? C.B. Dwivedi, Phys. of Plasma (1997) accepted.

6. Coulomb condensation effect and a possible physical model for the phase transition in a non-ideal plasma. C.B. Dwivedi and M. Bhattacharjee in Abstract proceeding of Int. Conf. on the Physics of dusty Plasma, Goa, Oct' 1996, Page 68.

7. Study of Sheath Phenomena in nigative ion Plasma. H. Bailung, A. Sarma and J. Chutia. Proc.ICPP, '96 Nagoya, Japan.

8. Sheath instability characterised by ion beam resources. H. Bailung, A. Sarma and J.Chutia Proc. XIth National Conf. on Plasma Sci. & Tech, Bhopal,1996.

9. Dust Acoustic solitions and Double Layers in a two-ion tenperature Plasma. S.G. Tagare and Joyanti Chutia. Proc. XXIIIrd ICPIG, France, 1997.

10. A new Mathematical Approach for Shock-Wave G.C. Das and C.B. Dwivedi. Proc. XIth National Conf. on Plasma Sci. & Tech, Bhopal, 1996.

11. Transient Behaviours of Solitary waves and DL in Plasmas. G.C. Das, S.G. Tagare, Jnanjyoti Sarma Proc XIth National Conf. on Plasma Sci. & Tech. Bhopal, 1996.

12. Some aspects of Solitons and DL in multiconponent plasmas. G.C. Das, lS.G. Tagore and Madhuri Talukdar. Proc. XIth National Conf. on Plasma Sci. & Tech, Bhopal, 1996.

13. Explosion of Soliton in Multi component plasma. G.C. Das and Jnanjyoti Sarma. Proc. XIth National Conf. on Plasma Sci. & Tech. Bhopal, 1996.

14. Steaming Instability of the ES Mode in a Magnitized Dusty plasma. C.B. Dwivedi and G.C. Das, ICPP-96, NaGoya.

15. Charactristic behaviour of Solitary Waves in relativistic Plasmas. G.C.Das and K.M. Sen. Ind. Journal of Pure & Appl. Physics, 1997 (accepted).

17. Exploision of Soliton in multi component plasmas. G.C. Das, Jnanjyoti Sarma, C. Uberoi Physics of Plasmas, 1997 (accepted).

Research Report :

1. "The construction of a Dusty Plasma Device", H. Sugai, M. Okano, H. Bailung, Y Nakamura. Research Report ISAS, Japan 1996.

2. Periodic quenching of the low -q Plasma discharge, N.R. Ray, C.B. Dwivedi and B. Dasgupta. PPG/SINP/3/96 July 1996.

3. Pulsation mode of gravitational collapse and its impact on star formation, C.B. Dwivedi, S. Bujarbaua and J. Chutia. CPP/RR-33/97.

4. Effect of external gravety on Plasma Sheath, C.B. Dwivedi, Kabita Rani Rajkhowa, S. Bujarbarua and J. Chutia. CPP/RR - 32/97.

Paticipation in Seminar, Conference etc. :

Dr. C.B.Dwivedi participated and Delivered an invited talk on "Calculation and Coulomb Correlation potential in a turbulent non-ideal plasmas with reduced degrees of freedom" 11th National Plasma Symposium held at Bhopal 28-31 Oct' 1996.

Any Other Important Activity :

Dr. C.B. Dwivedi has been nominated as a Councllor of Plasma Science Society of India for the period of 1996-98.

Prof. P. M. Neuman, Department of Mathematics, Queen's College Oxford University, U.K. visiting the Plasma Physics Division, IASST

MATHEMATICAL SCIENCES DIVISION :

Research activities on certain important areas of Mathematics and Statistics have been carried out in the Mathematical Science Division.

1. q-Series and Partition Theory

2. Probability and Statistics

3. Harmonic Analysis

Below is given the summary of the work done by the faculty members during the year 1996-97.

1. q-Series and Partition Theory :

Using a technique of Agarwal and Bressoud 1989, several new combinatorial identities were found. One of them states as follows:

"Let $A_1(n)$ denote the number of lattice paths of weight n which start at (0,0), have no valley above height 0, no plain with odd length. Let $B_1(n)$ denote the number of ordinary partitions of n into parts which are either odd or congruent to $\pm$ 4 (mod 20). Set $C_1(n)$ denote the number of partitions of n with" n copies of n" such that:

(a) even parts appear with even subscripts and odd with odd, and

(b) each pair of parts has nonnegative even weighted difference. then

$A_1(n) = B_1(n) = C_1(n)$ for all n.

All these combinatorial identities will appear in Utilitas Mathematica (Canada). A bijection between n-color partitions on the one hand and plane partitions on the other has been discovered. This will help in finding Rogers Ramanujan type identities for plane partitions and will thus solve an important problem of partition theory unsolved for a long time.

2. Probability and Statistics:

The generalized quasi factorial series distributions have been defined. This gives rise to several known as well as new discrete distributions. It is found that these distributions give

more general approach for finding various discrete distributions which occur in real life situations. (Published in Sankhya, 1996, 58, Series B,p. 159)

Again in sequel to the earlier work we have defined generalized quasi multivariate factorial series distributions. This gives a unified approach to study various multivariate discrete distributions. It is found that these distributions give more general approach for finding various multivariate discrete distributions occurring in real life situations.

Further, a general approach to study various quasi binomial distributions has been defined. It is found that this quasi binomial distributions having its application in real life situations.

3. Harmonic Analysis :

The problem of existence of finite universal Korovkin sets in centre of group algebra $Z\{L^1(G)\}$,where G is a central topological group, has been solved. It is proved that $Z\{L^1(G)\}$ has a finite universal Korovkin set iff G is a finite dimensional separable metric space. This is equivalent to the fact that G is separable metrizable and G/K has finite torsion free rank, where K is a compact open normal subgroup of certain direct summand of G.

The Science & Technology Manpower Study Cell:

The S&T Manpower Study Cell took up at the beginning of the year, the implementation of the D.S.T. sponsored project entitled (i) "Utilisation and Career Profile of Post-Graduates and Ph.Ds in Higher Educational Institutions in the N.E. Region."

Objectives of the Project:

The Ph.Ds and Post-Graduates in Science & Technology, Ph.Ds in particular, have to play a very important part in R & D activities. In this background, Statistics of these categories of S & T Personnel together with quantitative analysis about their utilisation and involvement in R & D activities, are of outmost importance. Information available on these aspects have however remained scanty in the country, more so, for the N.E. Region. This study has been formulated by this Institute with the objective of removing these vital data gaps for the N.E region. The D.S.T., Government of India agreed to sponsor this project with Professor J. Medhi as, Principal Investigator. The D.S.T., sanctioned the project in January 1996 (vide

D.S.T.'s Reference No. DST/NSTMIS/05/04/95 dated 3-1-96). The duration of the project is for 24 months and involves a total cost of Rs. 6,07,200.00. The Investigating team, besides the P.I. and Co-P.I. consists of 3 Research Investigators.

The broad objectives of the project are :

i. to study the utilisation and Career Profile of Post Graduates and Ph.Ds. in Science and Technology. This is sought to be done on the basis of data on a number of parameters having bearing on, career and activity status of the Ph.Ds and Post Graduates like, age, sex, specialisation, employment status, sector of employment, nature of duties, earning level, service mobility, research interest vis-svis involvement in research work, projects handled, papers published, work satisfaction and other relevant qualitative data in order to bring out the inter relationship between these parameters.

This being the first study of its kind in this region, it has been conceived of as only of pilot nature. The target population consists of, (i) all Ph.Ds produced by the Universities of the N.E. Region during one year, i.e. 1990-91.

ii. To study the extent of involvement in R & D activities of Ph.D. Degree holder faculty members working in higher Educational Institutions (viz. Universities and other colleges providing P.G. courses in S&T subjects) of the N.E. Region. This assessment is proposed to be done through appropriate analysis of data to be collected from individual Ph.Ds on a number of parameters like, (a) Quantum of R&D activities undertaken in terms of, number, nature and volume of R&D Projects handled, (b) Quantification of time spent of R&D activities (like, handling of research projects, guiding Ph.D./M.Phil. scholars, industrial consultancy etc.) and on Non-R&D activities (like teaching, administration, Seminars/ Workshop etc.) and (c) Out-put indicators like number of Ph.D/M.Phils. produced, papers published etc.

Achievements so far :

The project, which was started in mid-February 1996, has made considerable progress during the year. The following phases of work have been completed:

i. Preparation, field testing and printing of Questionnaires etc. (ii) Collection of names and addresses of Ph.Ds and the target group of P.Gs passing out from the N.E. Universities

from the records of all universities (iii) Collection of the list of Ph.D. faculty members/ scientists/Post-Doctoral Fellows from all S&T departments of the universities of the N.E. States and collection of list of projects (iv) Mailing of Questionnaires I:A and I:B-Pt-I to the Ph.Ds and Post-graduates (v) Supplying Questionnaires to the Ph.D. faculty members in higher educational Institutions primarily through personal contact. By the end of year, in totality, about 30 p.c. of the returns from target population has been received and follow up action through postal reminders as well as through personal contact by the investigator, for collection of returns continued.

The Project Advisory Committee (P.A.C) of the D.S.T. reviewed the progress of the project in its Review-Meeting held on 20-21 Feb.'97 at Hyderabad which was attended by the CO.P.I.

Research Publications :

1. N-color partitions with weighted differences equal to minus two, A.K. Agrawal and R. Balasubramaniam, International Journal of Mathematics and Mathematical Sciences (USA), 1997, Vol.20, No.4.

2. Lattice paths and n-color partions, A.K. Agrawal, Utilitas Mathematica (Canada), to appear.

3. q-special functions and combinatorics, A.K. Agrawal, Proceedings of the Workshop on special Functions and Differential Equations, Jan. 13-24, 1997, MAT SCIENCE, Madras, K. Srinivasa Rao-Editor, to appear.

4. Some aspects of generalized quasi factorial series distributions, Das, K.K., Sankhya, Ser. B, 1996, 58,pt. 2,159-169.

5. Some aspects of generalized quasi multivariate factorial series distributions, S.B. Nandi and K.K. Das,(1997), Sankhya, Ser. A, 1997 (in press).

6. Some aspects of a class of quasi-binomial distributions, K.K. Das, Assam Statist. Rev. (in press).

Other Activities of Scientists :

All the faculty members are activly engaged in promoting the cause of Mathematics. This fact is clear from the following list of their activities during 1996-97.

1. Prof. A.K.Agarwal delivered an invited talk on "On some partition problems". IIT, Madras, July 3, 1996.

2. Prof. A.K. Agarwal delivered an invited talk on "New classes of partition identities", MATSCIENCE, Madras, July 11, 1996.

3. Prof. A.K. Agarwal delivered an invited talk on "Rogers-Ramanujan identities for plane partions" in a symposium on Ramanujan's Mathematics during the 62nd Annual conference of Indian Mathematical Society held at IIT, Kanpur, (Dec. 22-25, 1996) on Dec. 23, 1996. He also chaired a session (Section B, Algebra, Number Theory and Lattice theory) on Dec. 25. 1996.

4. Prof. A.K. Agarwal delivered an invited talk on "Self-conjugate plane partitions" in a conference on Mathematics, University of Lucknow on Dec. 28.1996.

5. Prof. A.K. Agarwal delivered an invited talk on "q-spacial functions and combinatorics" in a Workshop on Special functions and differential Equations, MATSCIENCE, Madras, Jan 13-24, 1997. He also chaired the Morning Session on 24-1-1997.

6. Prof. A.K. Agarwal delivered an invited lecture on "Ordered partitions" at IIT, Guwahati, on March 6.1997.

7. Dr. K.K. Das presented his paper (with S.B. Nandi, and G.C. Das), "Generalized quasi multimonial distributions", in the International conference on "Stochastic and numerical modelling and applications" held on January 06-08.1997 at Utkal University, Bhubaneswar, Orissa.

8. Dr. K.K. Das Presented his paper (with S.B Nandi, and D.C.Nath), A probability model estimating the risk of out-migration for rural areas of India", in the XX Anual conference on "Indian Association for the study of population", held at Bharathiar University during

Feb.12-14,1997.

9. Dr. M.R. Agarwal participated in "Fifth Ramanujan Symposium on Harmonic Analysis (March 13-15, 1997) held at Ramanujan Institute for Advanced Study in Mathematics, University of Madras, and delivered a talk entitled "Finite universal korovkin sets in the centre of group algebras".

10. Prof. A.K. Agarwal refereed research articles for a reputed journal.

11. A Workshop on "Special Functions & Differential Equations" was held at MATSCIENCE, Madras, Jan. 13-14, 1997. Prof. A.K. Agarwal was a member of the Organizing Committee and Co-ordinator for the NE-Region. Prof. A.K. Agarwal acted as a resource person in the 3rd Refresher Course in Mathematics held at Academic Staff College, Guwahati University, Feb. 17-March 9, 1997 and delivered a lecture on "Partition identities" on 24-02-1997.

LIFE SCIENCES DIVISION:

Life sciences division is actively engaged in research activities on certain priority areas in the fields of Biofertilizer, Phytopathogenic fungi on major economic crops of Assam, Phytochemistry and Pharmaecology of Medicinal and Economic herbs of N.E. Region of India and Development of Muga Silk Culture of Assam as described below:

(a) Rhizobium Biofertilizer :

Studies and development and also to reduce pollution in the environment. Search for appropriate micro-organism (s), symbiotic or asymbiotic for future biofertilizer is continuing world wide. The division has been working on a research project, "Studies on Rhizobium biofertilizer for improvement of pulse production in Assam". Isolation and identification of the native Rhizobium strains of Assam particularly isolated from Blackgram and greengram collected from six districts viz. Kamrup, Nalbari, Nagaon, Sonitpur, N.Lakhimpur and Jorhat of Assam are in progress. A good number of isolates have been tested both in the laboratory and in the field for their efficiency of nodulation and nitrogen fixation. Quite a few number of strains have been found efficient and further studies of their wide range and acid tollerance are in progress along with the serogrouping of the strains so far isolated. The working group has also taken initiative to work on biofertilizer production with the selected efficient strains(s) and also to motivate and train the local farmers for its use.

(b) Phytopathogenic fungi :

Crop loss to diseases is not new to the cultivators but there is no accurate data on crop loss due to diseases. Fungi causes most devastating diseases but a full taxonomic and epidemiological records of major diseases are lacking. Further, there is no record of disease free and disease prone areas and seasons for major crops of Assam. So, diseases cannot be forcasted at all and planning of agricultural crop in Assam remains a dream. The division with its working scientific group has actively studying the above aspects of four major diseases viz. Blast and Sheath blight of rice, red-rot of sugarcane and blight of potato of Assam.

Sample of the above diseases on the respective crops have been collected and few of them have been isolated and identified. In vitro and in vivo studies on some epidemiological and biochemical studies are in progress. Biocontrol of the diseases has already been taken up

considering the need of the hour for shifting from chemical control to biocontrol. Control of red-rot of sugarcane with biocontrol method has already been taken up and are in progress.

(c) Phyto. Chemistry & Pharmacology :

In this section of Medicinal and Economic plant, Research activities on the study of the efficacy of some of the selected Medicinal plants have been under taken. The group has at present undertaken study on a few potent medicinal plants to find out the active principle(s) and to study the biochemistry, Pharmacology and therapeutic values of these plants traditionally used by the people of North-Eastern region.

Presently, the group is engaged in evaluating the plants reported to have antihypertensive and hepatoprotective values in the Ayurvedic system of medicine. In continuation of the previous years work on hypotensive plant, the group has undertaken a comparative study of different extracts on experimental animals by adopting different mode of application on them and also studied the other effects of the plant C. colibrokianum on the anatomy of experimental animals.

Extensive work on the plant L. lavendulefolia has been taken up by this group in this section and has determined the LD_{50} of this plant in different form on experimental animals. Experimants on animals to study hepatoprotective action of the above mentioned plant os running in full pace and encouraging results are obtained from these experiments.

A survey in the nearby areas has been conducted for the presence of hepato protective plants as presented in the traditional system of medicine in which Dr. P. Gogoi, Head of Botany Dept., D.B. College, Golaghat was also in the survey team. We have already collected some important medicinal plants claimed to have hepato protective, hypertensive and hypogycemic effect.

(d) Muga silkworm Project:

In continuation of the field demonstration programme of Indoor Rearing technique of muga silkworm partaining to the project sponsored by the department of Science & Technology, Govt. of India, New Delhi, two demonstration cum training programmes of the technique were conducted, one at Barkuchi village in Mirza and another at Mairapara village in Rani during the year 1996-97.

For want of suitable house in the localities the rearings had to be conducted in both the places under G.I. Sheet roofed houses that lacks proper conditions for rearing purposes. When the requirement of temperature for late aged larvae (4th & 5th instar) is only 22° - 25°C, the larva had to face temperature up to 34° and 36°C at Rani and Mirza respectively. Naturally it affects the 4th and 5th instar larvae. Inspite of the practical difficulties cited above larvae could be brought to maturing stage and cocoons could be harvested accordingly in both the places. There was, however, no mortality curing their young stages (1st, 2nd & 3rd instars) as they could withstand relatively high temperature.

Through in certain localities some owner of the trees prevented the trainees to collect twigs and brunches of food

trees for feeding the larvae with plucked leaves, women (8) and men (3) participated the programme from the beginning till the end and made it a success. Many people visited the rearing sites in both the places and showed eagerness and inquisitiveness about the technique.

Besides demonstration of rearing techniques and training, certain biochemical works on leaf quality of primary food plants of Muga silkworm have been continuing.

Research Publications :

1. Studies on antimicrobial activity of some essential oils, The national symposium on diseases of economically important plants of Eastern India and their management, P. Azad & R. Sarma held at NBU by IPS (abstract published), 1996.

2. Transaminase activity of the ethylacetate extract of C. Colibrookianum Walp., R. Devi and D.K. Sharma, XXIX. National Conference of pharmacology, held at Hyderabad, 1996.

3. Seasonal variation on foliar constituent of Som (Machilus bombycina, K) And Soalu (Litsea polyantha, J.), D.K. Sharma and D. Devi, Sericologia 37 (I), 1996.

Participation in Seminars, Conference etc. :

a. Mr. Dhrubajyoti Duwarah, JRF, participated in the workshop on instrumentation held

at RSIC, Shillong from 29 October to 2nd Nov' 96, sponsored by DST, Govt. of India.

b. Ms. Rajlakhi Devi, presented a paper in the XXIX National conference of Pharmacology held at Hyderabad.

Training :

1. Dr. P. Azad has obtained a three week training on Microbial Gene Transfer Technology during December 1996, at the Institute of Microbial Technology, Chandigarh.

Other activities :

I. The indoor rearing technique of Muga Silkworm alongwith other sericulture related materials was exhibited at the following places:

i. Nalbari College, Nalbari on their Golden Jubilee celebration during January 1997.

ii. Banikanta College of teachers education on the occasion of National Science Day during February 1997.

II. Dr. (Mrs.) D. Devi participated in the " Brain Storming Session on application of Biotechnology to eri silkworm", jointly sponsored by the DBT and CSB on 10th and 11th July, 1996 at Guwahati.

RESOURCE MANAGEMENT AND ENVIRONMENT DIVISION :

The Resource Management and Environment Division (RM&ED) of the IASST has been carrying out research on oil pollution caused due to various activities since ;its inception in 1991. Investigation on "A study on impact of oil exploration on microflora in rice field soil of Assam" Sponsored by the Ministry of Environment and Forests, Govt. of India had been taken up under the Guidance of Dr. L.C. Kagti, Rtd. Professor and Head, Department of Botany, Gauhati University and also Honorary Professor of the Division. The final technical report of the said project has already been published and submitted to the Ministry of Environment and Forests, Govt. of India for necessary action.

Research activities under another project on "development of Microbiological Method(s) for Control of Hydrocarbonaceous Pollutants in Soil of Assam. A "Feasibility Study" sponsored by DST, Govt. of India Have been isolated from petroleum bollunted soil of Assam and they were subsequently characterised.

Database on research on flora and Fauna :

The RM & ED of IASST has collected various information on resource management and environment carried out by different organisations on the flora and fauna including environment of the North Eastern region and prepared a database on "Research on Resource Management and Environment of N.E. Region". The database was aimed at finding out the gap/deficiencies of research work carried out by different organisations/agencies. The database was prepared in two volumes with the financial assistance of the Ministry of Environment and Forests, Govt of India, New Delhi.

Project Proposals submitted :

Two high level committees viz-Expert Committee and Steering Committee were constituted as per decision in the meeting held on 4th October, 1994 the Ministry of Environment and Forests, Govt. of India, New Delhi for selecting and recommending thrust areas on which research activities are to be carried out at the IASST.

Based on the thrust areas as selected by the Expert Committee and subsequently recommended by the Steering Committee, The following project proposals have been submitted to the Ministry of Environment and Forests, Govt. of India for financial assistance.

1. Study on the impact of oil production operation on heavy metal pollution in and around the oil fields of Upper Assam.

2. Environmental impact of long term coal mining in Assam with particular reference to heavy metal pollution of water bodies.

3. Impact of dust emission on soil, water, plant and human health in and around Bokajan Cement Factory.

4. Study on the impact on application of pesticides in tea, tea soil, on tea plant and on water and soil in and around some tea gardens of Assam.

During the year 1996-97, the division has purchased some equipments viz-Flame photometer, Research microscope, Electrical microprocessor balance, Shaking machine with B.O.D. incubator, High speed contrifuge, Micropipettes, Air conditioner etc. besides remodelling of existing laboratory from the "Seed Money" provided by the Ministry of Environment and Forests, Govt. of India.

Research Publications :

1. Utilization of crude oil by Azotobacter Chroococcum. S. Deka, Proc. Acad. Env. Biol. Vol. 5 p. 14, 1996.

2. Studies on the impact of crude oil pollution on physico chemical properties, Nature of micro organisatons and growth of rice plants in soil, S. Deka, A. Devi, H.P.Barthakur and L.C. Kagti, Env. Biol. 18(2) PP. 167-171, 1997.

3. Impact of oil field operations on soil quality and rice grain near two Assam Oil fields. A. Devi and K.G. Bhattacharyya, Proceeding on the all India seminar on challenging problems in Environmental Management pp. 171-182, 1996.

4. Influence of long term oil field operations on physico chemical quality of soil and transport of a few metals to rice grain, A. Devi and K.G. Bhattacharyya. Abs. Assam Sci. Soc. Tech. Sess., 1996.

Participation in Seminar, Conference etc.:

1. Dr. S. Deka, Assistant professor attended a training programme on "Taxonomy and Molecular Biology of actinomycetes" held at the Institute of Microbial Technology, Chandigarh from September 30 to October 12, 1996.

2. Dr. S. Deka, Assistant professor participated in a workshop on "Patent Awarness" held at North Eastern Hill University, Shillong on 16-17th November, 1996.

3. Dr. S Deka, Assistant Professor participated in the Seminar on "Aforestation" held at Burnihat Forests College on March 4-5, 1997.

4. Dr. S. Deka represented his project entitled "Development of Microbiological Method(S) for control of hydrocarbonaceous pollutants in soil of Assam a feasibility study" in the group Monitoring workshop of principal investigator held at NBRI, Lucknow no March 26-27, 1997.

5. Miss A. Devi, Senior Research Assistant RM&ED presented her paper entitled "Impact of oil field operations on soil quality and rice grain near two Assam oil fields" in the National Seminar on Challenging Problems in Environmental Management at Nagpur.

MANPOWER DEVELOPMENT PROGRAMME :

Computer Science Division :

The Computer Science Division is engaged primarily in education and training in the field of Computer Science and Applications. It has been conducting the following three courses.

1. Post Graduate Diploma in Computer Application of one year duration.

2. DOEACC 'A' level course of one year duration.

3. Advanced certificate course of six months duration.

Besides conducting the regular courses the Computer Science Division has also been organising special training programmes on request. 70 students belonging to different minority communities were admitted into the Advanced Certificate course for which financial support has been given by the Assam State Minorities Board. The examination for the course was held during April'96 and all the 37 students, who appeared in the examination, have passed the examination. During February'97 another batch of 70 candidates has been admitted into special six months Advanced Certificate course for Minority Communities.

The division has helped in the research programmes of the IASST by providing computer time and consultancy services. The division has been doing jobs like statistical data analysis as well as graph and report preparation for research scholars and others of the Institute.

Participation of Seminar, Conference etc. :

1. Shri A. Barman attended the workshop on DOEACC 'A' Level course curriculum and examination organised by DOEACC Society at New Delhi on April 6, 1996.

2. Ms. L.B. Mahanta attended the Winter School on "Logic and Computer Science" from 23 to 10th Jan'97 conducted by Indian Statistical Institute, Calcutta.

3. Ms. Madhuri Talukdar Attended the XI-th PSSI National Symposium on Plasma Science and Technology (Plasma'96) at Bhopal from 28-31st Oct.'96 as a part of her Ph.D. Programme.

Academic Pursuit :

Shri B. Borah has successfully competed first two semesters of the three semester M.S. (system & Information) course of Birla Institute of Technology & Science, Pilani.

ON GOING PROJECTS :

Plasma Physics Division :

"Study of the Sheath Induced Non-linear Phenomena in Multi-component Plasma", Sponsored by the DST, Govt of India.

Research Group :

1. Dr. Joyanti Chutia	Principal Investigator
2. Dr. G.C. Das	Co-investigator
3. Dr. C.B. Dwivedi	Co-investigator
4. Sri Arun Kumar Sama	JRF
5. Sri Ashok Kumar Das	JRF

Mathematics & Statistics Division :

1. "Development of Mathematical Sciences Division" Splnsored by the DST, Govt. of India.

Research Group :

1. Dr. A.K. Agarwal	Principal investigator
2. Dr. K.K. Das	Co-investigator
3. Dr.(Mrs) M.R. Agarwal	- do -
4. Ms. Barnali Dutta	JRF
5. Ms. Sangeeta Kalita	JRF

2. S & T Manpower Study Cell :

"Studies on utilisation and career profile of post graduate and Ph.Ds in Science & Technology and to the extent of R & D activities undertaken by the Ph.D's in higher educational institution in the N.E Region". Sponsored by the DST, Govt. of India.

Research group :

1. Professor J. Medhi	Principal Investigator
2. Sri D.N. Das	Co-Principal Investigator
3. Sri Kaushik Saha	Investigator
4. Sri Manab Hazarika	-do-
5. Sri S. Dey	-do-

Life Sciences Division :

1. "Development of Herbal Medicine with special reference to Hepatic Disorder", sponsored by the DST, Govt. of India.

Research Group :

1. Dr. J. Kotoky	Principal Investigator
2. Dr. P.N. Das	Co-investigator
3.(a) Sri J.C. Gogoi	JRF
(b) Sri Dhrubajyoti Duwarah	JRF
4. Ms.Raj Lakhi Devi	Senior Research Assistant.
5. Sri N. Sharma	Sr.Research Assistant-cum Animal Keeper.

2. "Development of Muga culture with special reference to indoor rearing technique", Sponsored by the DST, Govt. of India.

Research Group :

1. Dr. J.N. Talukdar	Hony. Prof. Principal Investigator
2. Mr. Subrata Goswami	Laboratory Assiatant
3. Tarun talukdar	Labortory Assistant

4. Mr. Balen Das	Field helper

3. "Studies on Rhizobium biofertilizer for improvement of pulse production im Assam", Sponsored by the DBT, Govt. of India.

Research Group :

1. Dr. P. Azad	Principal Investigator
2. Mr. Arup Kr. Deka	S.R.F.
3. Mr. Ranjan Kalita	Jr. Reasearch Assistant
4. Mr. Nalini Dutta Lahkar	Field-cum-laboratory Assistant

4. "Survey, collection and of phytopathogenic fungi on cultivated crops of Assam", Sponsored by the ASTEC, Govt. of Assam.

Research Group :

1. Dr. P. Azad	Principal Investigator
2. Mr. Ratul Saikia	J.R.F.

Resource Management & Environment Division :

1. "Development of Microbiological Method(s) for control of hydrocarbonaceaous pollutants in soil of Assam- a feasibility study", Sponsored by the DST, Govt. of India.

2. "Database on research on Resource Management and Environment of N.E. Region", Sponsored by the Ministry of Environment and Forests, Govt. of India.

Research Group :

1. Dr. S. Deka	Assistant Professor
2. Dr. N. D. Bordoloi	Research Assistant
3. Sri Sunil Deka	Computer Programmer
4. Sri Manmohan Hujury	Laboratory Assistant

Annual Receipts and Payments Accounts, 1996-97 (Abstract)
Institute of Advanced Study in Science and Technology
Khanapara, Guwahati-781 022

Receipts		Payments	
Particulars Sources of receipts.	Amount Rs.	Particulars of Heads of expenditure	Amount Rs.
1. Opening balance	35,51,746.29		
2. Grants from Govt. of Assam for maintenance etc. for General Office Management.	40,00,000.00	1. General Office Management including P.P. Div., Computer Sc. Div. & Resource Management & Environment Div. etc.	39,99,643.55
3. Grants from Govt. of India, DBT for Biofertilizer Project.	1,30,000.00	2. Biofertilizer Project.	2,13,904.00
4. Grants from Govt. of India, DBT for Micro-method Project.	25,000.00	3. Micro-method Project.	43,294.00
5. Grants from Govt. of India, DST for Mathematics and Statistics Division.	10,40,000.00	4. Mathematics & Statistics.	7,56,334.00
6. Grants from Govt. of India, DST for Herbal Medicine Project.	4,00,000.00	5. Herbal Medicine.	5,95,563.00
7. Grants from ASTEC, Govt. of Assam for Fungi Project.	--	6. Survey and Collections for Fungi Project.	39,950.00
8. Grants from Govt. of India, DST for Utilisation of Carrear Profile.	--	7. Utilisation of Career Profile Project.	3,09,842.00
9. Grants from Govt. of India, DO for Resource Management & Environment (Seed Money).	--	8. Resource Management and Environment Project. (Seed money).	10,03,755.00
10. Grants from Govt. of India, DST for Sheath non-linear in Plasma Physics.	1,10,000.00	9. Sheath Non-linear in Plasma Physics Project.	59,623.00
11. Grants from Govt. of India, DST for Muga Culture Project.	3,50,000.00	10. Muga Culture indoot rearing.	2,58,447.84
12. Grants from Govt. of Assam, for dev. of land & building for IASST.	--	11. Dev. of Land & Building.	52,500.00
13. Grants from Govt. of Assam, for Education.	3,00,000.00	12. Education.	--
14. Grants from Govt. of India, DST for dev. of Plasma Physics (New).	25,40,000.00	13. Dev. of Plasma Physics (New Project)	--
15. Misc. Grants & other Receipts of Interest etc.Creditable to IASST Fund.	8,63,604.10	14. Misc. payments under IASST fund.	1,41,178.00
		15. Closing Balance	58,36,316.00
Total Rs.	1,33,10,350.39	Total Rs.	1,33,10,350.39