

## SCHOOL OF PHYSICAL SCIENCES

The School of Physical Sciences came into existence in 1974 with the establishment of Department of Mathematics. Later on, in 1976, the departments of Chemistry and Physics were opened and subsequently the Centre for Science Education and Centre for Applied Statistics were established.

The School aims at being a dynamic centre for post-graduate studies and research at the frontiers of physical sciences. The departments are devoted/ committed for advanced research and teaching and have made notable strides in several frontier areas of Chemistry, Physics and Mathematics. Some of the Faculty Members have established strong interaction with premier research institutions in India and abroad.

The Centre for Science Education is endeavouring, in the past few years of its existence, to be a leading centre to develop scientific temper and spirit of enquiry among the younger generation. In recognition of the contributions made by Professor Man Mohan Singh for popularisation of science among the children, the National Council of Science and Technology Communications, Department of Science and Technology, Government of India has given him the national award. The Centre for Applied Statistics offers courses for various Departments.

### Centre for Applied Statistics

The Centre was established in 1984 with the objective of conducting teaching, research and training programmes in the field of Applied Statistics.

**Head :** Dr M K Das

#### **Faculty :**

Name and Degree

Designation

M K Das, PhD (Dibrugarh)

Reader

G Das, PhD (NEHU)

Sr Lecturer

B K Gupta, MSc (Alig), MSc (Agra)

Sr Lecturer

#### **Student Intake :**

(a) Enrolment capacity : 10

(b) Actual Admission : 2

| SC/ST | Gen | Male | Female | Total |
|-------|-----|------|--------|-------|
| 2     | -   | 1    | 1      | 2     |

**Courses conducted :** Certificate Course in Statistics.

Mathematics & Descriptive Statistics; Computational Techniques & Elements of Probability Theory; Probability Distributions & Vital

Statistics Methods; Economics Statistics & Indian Official Statistics; Descriptive Statistics & Sampling Distributions; Statistical Methods & Practical Problems on the topics covered in Statistical Methods; Sampling Techniques & Statistical Quality Control; Analysis of Variance & Experimental Designs.

**Seminar/Conference etc. :**

Mr. B.K.Gupta attended the Golden Jubilee session of the Indian Society of Agricultural Statistics at Indian Agricultural Statistics Research Institute, New Delhi from 19th to 21st December 1996 and presented a joint paper with Prof.T.J.Rao on 'Stratified PPS Sampling and Allocation of Sample Size'.

**Other Activities :**

(i) Dr.M.K.Das and Dr.(Mrs).G.Das taught Biometrics in the 4th Semester M.Sc. Zoology Course; (ii) Dr.M.K. Das taught Biostatistics paper in the 3rd Semester M.Sc. Anthropology (July 1996 to December 1996) Course; (iii) Dr. M.K. Das attended a School on Statistical Quality Control and Reliability at Indian Statistical Institute, Calcutta from 17th March, 1997 to 29th March, 1997; (iv) Mr. B.K.Gupta attended a 'School on Sample Survey' at Indian Statistical Institute, Calcutta from 28th October to 5th November, 1996; (vii) Dr. (Mrs) G.Das was appointed as referee for the journal "Communication in Statistics : Theory & Methods" Published from U.S.A.

**Department of Chemistry**

The Department has made significant progress in its academic activities comprising both teaching and research programmes. The M.Sc. Syllabus was revised and came into effect from August 1996. The Special Assistance Programme given to this Department has helped to strengthen the various teaching and research programmes of this Department. The Department has a number of research projects in progress, and has continued to maintain scientific collaborations with leading institutions in India and abroad.

**Head :** Professor Mahendra K Mahanti

**Faculty :**

| Name and Degree                         | Designation |
|---|-------------|
| H Junjappa, PhD (Karnataka)             | Professor   |
| H Ila, PhD (IIT Kanpur) on lien         | Professor   |
| S N Bhat, PhD (IIT Kanpur)              | Professor   |
| M K Chaudhuri, PhD (IIT Kanpur) on lien | Professor   |
| M P Mahajan, PhD (Punjabi Univ) on lien | Professor   |
| M K Mahanti, PhD (Berhampur)            | Professor   |
| R K Poddar, PhD (IIT Kanpur)            | Reader      |
| K Ismail, PhD (AMU)                     | Reader      |
| K K Dwivedi, PhD (IIT Kanpur)           | Reader      |
| H Chandra, PhD (Punjabi Univ)           | Reader      |

|   |          |
|---|----------|
| B Marboh, PhD (NEHU)                    | Reader   |
| S Aravamudhan, PhD (IIT Kanpur)         | Lecturer |
| Z Hiese, PhD (NEHU) on leave            | Lecturer |
| A Lemtur, PhD (NEHU)                    | Lecturer |
| F M Nongrum, PhD (Leeds, UK) (on leave) | Lecturer |
| R H Duncan Lyngdoh, PhD (IIT Madras)    | Lecturer |

**Student Intake :**

M.Sc : Enrolment Capacity : 29  
Actual Admission

| Gen | SC/ST | Male | Female | Total |
|-----|-------|------|--------|-------|
| 09  | 19    | 17   | 11     | 28    |

Ph.D. : 06

**Degrees Awarded :**

Ph.D. :

1. Gagan C. Mandal, "Some Aspects of Mixed Ligand Complexes of Manganese, Peroxo Compounds of Lolybdenum and Biomimetic Chemistry of Vanadium Bromoperoxidase". Supervisor, Professor M.K. Chaudhuri.

2. Babul C. Paul, "A Study (I) on the Micellization Behaviour of Surfactants in Aqueous Electrolytic Solution and (II) on the Indicator Equilibria in Microemulsion". Supervisor, Dr. K. Ismail.

**Funds received from agencies other than NEHU/UGC :**

- (a) State Council of Science, Technology and Environment, Government of Meghalaya : Rs. 3.09 lakhs
- (b) BRNS, Department of Atomic Energy, Mumbai : Rs. 4.09 lakhs
- TOTAL : Rs. 7.18 lakhs

**Courses conducted : (Compulsory)**

Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Quantum Chemistry, Laboratory Course in Inorganic Chemistry, Chemical Binding and Molecular Spectroscopy, Laboratory Course in Organic Chemistry, Applications of Spectroscopic Methods, Laboratory Course in Physical Chemistry, Analytical Chemistry and Computers.

**(Optionals)**

Inorganic Chemistry, Organic Chemistry Physical Chemistry, Project Work (Inorganic Chemistry), Project Work (Organic Chemistry), Project Work (Physical Chemistry).

**Refresher Course :**

The Department had conducted the 15th refresher course for college and university teachers from November 23 to December 13, 1996. Dr. H.Chandra was the Course Coordinator. The highlight of this course was the inclusion of a 10-day programme covering

various aspects of Nuclear Chemistry. Apart from 9 internal resource persons, 8 external resource persons participated in this course. They were: Dr.D.D.Sood, Dr.S.B.Manohar, Dr.V.N.Vaidya, Dr.(Mrs) V.Sagar and Mr. J.V.Dehadraya (all from the Bhabha Atomic Research Centre, Trombay, Mumbai; and Dr. S.K. Das, Dr. M.K. Das, Dr. S.K. Saha and Dr. D.P.Chaudhary (all from the Department of Atomic Energy Centre, Calcutta).

#### **Seminar/Conference etc. :**

1. Prof. S.N.Bhat (a) delivered a lecture at the Convention of Chemists held at Coimbatore (December 26-29, 1996) on "Host-Guest interactions : Spectroscopic Investigations of Cyclodextrins with Acridine and Phenolphthalein"; (b) attended the symposium on "Toxic Metal Ions" at Bangalore University, Bangalore (February 3, 1997) and delivered a lecture on "Role of Polyelectrolytes in the Removal of Toxic Metal Ions from Waste Water" on Feb. 3, 1997 at Bangalore University, Bangalore (c) Delivered four lectures in refreshers course in chemistry at Guwahati University, Guwahati.

2. Prof. M.K.Mahanti attended the National Symposium on "Solution Chemistry" held at Utkal University, Bhubaneswar (January 28-30, 1997), and delivered a lecture on "Recent Trends in Chromium (VI) Oxidations".

3. Dr. R.K.Poddar attended the Refresher Course in Chemistry at Gauhati University, Guwahati (November 29-30, 1996) and delivered four lectures on "Symmetry and Group Theory".

4. Dr.K.K.Dwivedi (a) attended the Accelerator User Committee Meeting held at New Delhi (July 7, 1996), and gave a lecture on "Material Modifications by Swift Heavy Ions"; (b) attended the 18th International Conference on "Nuclear Tracks in Solids", held at Ain Shams University, Cairo, Egypt (September 1-5, 1996) and delivered an invited lecture on "Angular Dependence of Heavy Ion Range (ADHIR) of Energetic 209 Bi In Mica and Polycarbonate"; (c) delivered a lecture at Arunachal Pradesh State Council of Science and Technology, Itanagar (October 8, 1996) on "Integrated Radon Monitoring in Dwellings"; (d) attended the Refresher Course in Chemistry at Gauhati University, Guwahati (December 3, 1996), and delivered two lectures on "Fullerenes" and Earthquake Prediction by Radon Monitoring".

#### **Visiting Professors/Fellows :**

1. Dr. B.C. Ranu, Department of Chemistry, Indian Association for the Cultivation of Science, Jadavpur, Calcutta, (21.6.96), who spoke on "Zinc-Mediated Reactions in Organic Synthesis".

2. Prof. O.K. Medhi, Department of Chemistry, Gauhati University, Guwahati (Visiting Fellow, October 21-November 4, 1996), who delivered lectures in the M.Sc.III Semester Course on "Bioinorganic Chemistry".

## Publications :

Bhat,S.N. and Dutta,R.K. "Interaction of Phenozinium Dyes and Methys orange with micelles of various charge types" Colloids and Surfaces : (A) Physicochemical and Engineering Aspect. 106 : 127 (1996).

Bhattacharyya,A., Dwivedi,K.K., Ghosh,S., Raju,J. and Saxena,A. "Response of solid dielectrics to the registration of fission product tracks" Rad. Eff. Def. in Solid, 138 : 335 (1996).

Brandt,R., Dwivedi,K.K., Ghosh,S., Laldawngliana,C., Sinha,D. and Srivastava,A. "Range and Energy-loss of 58 Ni and 129Xe in hostaphan" Indian J.Pure and Appl. Phys. 34 : 371 (1996).

Brandt,R., Dwivedi,K.K., Ghosh,S., Saxena,A., Sinha,D. and Srivastava A. "Energy-loss and mean ranges of 86Kr and 197 Au in Tantalum" Int. J. Radiat. Appl. Instrum. (Part D) : Radiation Meas., 26 : 561 (1996).

Chakravorty,R., Lemtur,A., Saloi,T.N., Shedbalkar,V.P., Subramanian,J. "Cyclic voltammetric and EPR studies on the Oxidation products of vanadyl mesoporphyrin" J. Phys. Chem. 100:4770 (1996)

Chaudhuri,M.K., Chettri,S.K., Paul,P.C. and Srinivas,P. "Fluoride-assisted stabilization of amino acid complexes of vanadium: Synthesis and characterisation" J. Fluorine Chem. 78 : 131 (1996).

Chaudhuri,M.K., Mandal,G.C. and Paul,P.C. "Synthesis and stuctual characterisation of peroxoarsenates" Ind. J. Chem. 36A : 235 (1997).

Debroy,A. and Mahanti,M.K. "Kinetics of oxidation of diols by quinolinium dichromate", Oxidation Communications, 19 : 251(1996).

Debroy,A.,Kuotsu,B., Mahanti,M.K. and Tiewsoh,E. "The quinolinium dichromate oxidation of diols: A kinetic study", J. Org. Chem., 61 : 8875 (1996).

Dwivedi,K.K., Laldawngliana,C., Lalramengzami,R., Saxena,A., Sinha,D., Srivastava,A. and Ramachandran,T.V. "Measurement of potential alpha energy exposure (PAEE) of radon and its progenies in dwellings in the North-Eastern Region of India" Int. J.Radiat. Appl. Instrum. (Part D): Radiation Meas., 26 : 291 (1996).

Gupta,A.K., Poddar,R.K., Sarker,S.C. and Sarkhel,P. "Mono and binuclear ruthenium (II) trifluoroacetato complexes containing monodentate co-digands" Trans. Metal Chem. 21 : 250 (1996).

Illa,H., Junjappa,H., Mohanta,P.K. and Yadav,K.M. "Regioseselective synthesis of substituted 1-methyl and 2-methylnaphthalenes" Tetrahedron 52 : 14049 (1996).

Illa, H., Junjappa, H., Patro, B., Suresh, J.R. and Yadav, K.M. "Stepwise controlled reduction studies on  $\alpha$ -oxoketene dithioacetals with Zn/ZnCl<sub>2</sub>/2 TMEDA in ethanol" Tetrahedron 51: 4679(1996).

Illa, H., Junjappa, H., Rao, M.V.B. and Reddy, K.R. "Direct Synthesis of 2-cycloalkylamino-3,4-substituted thiophenes via selective deprotonation-cyclization of arylketene N,S-acetals" Synth. Comm., 26 : 4157 (1996).

Illa, H., Junjappa, H., Rao, M.V.B. and Sathyanarayana, J. "Synthesis and Lewis acid assisted rearrangement of novel donor-acceptor substituted cyclopropanes: Highly stereoselective [4+1] annulation approach to substituted and spiro cyclopentene derivatives", Tetrahedron Lett. 3565 (1996).

Karim, E. and Mahanti, M.K. "Kinetics of oxidation of glutamic acid and aspartic acid by quinolinium dichromate", Oxidation Communications, 19 : 582 (1996).

Kharpuria, E., Mahanti, M.K. and Nongkynrih I. "Kinetics and mechanism of oxidation of allylic alcohols by quinolinium dichromate", Oxidation Communications, 19 : 258 (1996).

Mahanti, M.K. and Nongkynrih, I. "Kinetics of oxidation of cyclic alcohols by quinolinium dichromate", Bull. Chem.Soc.Japan, 69 : 1403 (1996).

Mahanti, M.K. and Singh, A.N. "The coupling reaction between phenol and benzyl alcohol : A kinetic study", Oxidation Communi-cations, 19 : 276 (1996).

Mahanti, M.K. and Singh, A.N. "Kinetics of oxidation of catechol catalyzed by tyrosinase", Oxidation Communications, 19:426(1996).

Mathew, F. and Myrboh, B. "Favorski type rearrangement in the lead tetraacetate oxidation of cycloalkanones" Synth. Comm., 26 : 1097 (1996).

Venkateswarlu, D., Lyngdoh, R.H.D. and Bansal, M. "Base-pairing potential of 8-oxopurines : A theoretical study", J. Chem. Soc. Perkin Trans. 2 : 912 (1997).

#### **Study Tour/Field Trip of Students :**

The Department organised a study tour for the M.Sc. students during January 8-31, 1997 led by Dr.A.Lemtur, Lecturer in the Department. 29 students participated. The team visited Bhabha Atomic Research Centre (BARC), Trombay, Tata Institute of Fundamental Research (TIFR) and Nehru Science Centre, Worli at Mumbai, Indian Institute of Science and Visveswarayya Industrial and Technological Museum at Bangalore, the chemical laboratories of the Madras University and IIT in Chennai and in Calcutta, Indian Association for the Cultivation of Science (IACS), Jadavpur University and Regional Computer Centre.

**Thrust Areas of Research :** Research activities in Organic Chemistry have focussed attention on developing newer synthetic methods for important heterocyclic and carbocyclic compounds of biological relevance. A number of such compounds are being screened for assessment of their activity. Synthetic and mechanistic studies on cycloaddition reactions of novel azadienes and oxyplumbation reactions are carried out. In Theoretical Organic and Bio-organic Chemistry, the research involves investigating the molecular basis of carcinogenesis, mutagenesis, and of the genetic code. Some activities on designing of DNA-like polymers and on time-saving techniques in computational chemistry are also being pursued.

Research activities in Physical Chemistry include work on the properties of organic semiconductors, nuclear interactions involving charge-transfer complexes, hydrogen bonding and hydrophobic interactions, and on micelles. Research in Chemical Dynamics pertains to electron-transfer processes, the use of newer reagents for oxidation, and in the design of novel methods for transition metal compounds derived from the reduction of transition metal ions by sodium tetrahydroborate. Work on the transport behaviour of electrolytes in aqueous and molten media as a function of temperature and pressure are actively pursued. Theoretical studies on vibrationally excited states are in progress. ESR studies on single electron transfer reactions and free radicals using the spin trapping technique are being carried out. EPR studies on the oxidation products of metalloporphyrins and related bio-inorganic systems are also being conducted. Studies on the redox potential of porphyrins and metalloporphyrins using cyclic voltametry are also being pursued. Research in the area of determination and applications of contributions to shielding tensors is being conducted.

Research activities in Inorganic Chemistry address to the synthesis, characterization and evaluation of molecular structures by different techniques. Studies on the reactivity of fluoro, peroxy/dioxygen and  $\beta$ -diketonatometallates, and fluoro and peroxy compounds of non metals, sulfoxide and arylazo complexes of transition metals are being carried out. Emphasis is also being given to studying the stabilization of unusual oxidation states of metals, and in the development of newer reagents and catalysts. Research activities related to Nuclear and Environmental Chemistry include heavy ion range and energy loss in solids, and in the development of nuclear track microfilters. Studies are being done on fusion-fission and particle evaporation, radon monitoring and the measurement of trace pollutants in the environment.

#### **Research Programmes/Projects :**

The Department has several ongoing research projects, sponsored by different funding agencies. New research projects initiated during the period under report, are :

1. Dr.K.K.Dwivedi :(a) "Assesment of Breathing Level Air Quality in Greater Shillong", by the State Council of Science, Technology and Environment, Government of Meghalaya; (2) Dr.K.K.Dwivedi : "Integrated Radon Monitoring in North-Eastern States", by BRNS, DAE, Trombay, Mumbai; (3) Dr.K.K.Dwivedi : "Material Modifications by Swift Heavy Ions", by the UGC.

#### Other Activities :

Professor H.Junjappa and Professor M.K.Chaudhuri served as members of the Programme Advisory Committee (PAC) of the Department of Science and Technology (DST), New Delhi. Professor M.K.Chaudhuri continued to be a member of the Science and Engineering Research Council (SERC) of the DST. Dr. K.Ismail was invited as a Visiting Fellow to the Department of Chemistry, Assam University, Silchar, during 16-22 February 1997 and 16-22 March 1997, and delivered a series of lectures on "Chemical Binding". Dr.K.K.Dwivedi was the Convener for a one-day workshop on "Patent Awareness" hosted by NEHU, on November 15, 1996 under the aegies of TIFAC, DST. Dr.K.K.Dwivedi attended a Conference on "Nuclear Energy and Its Applications in Medical Sciences", held at Guwahati (December 2, 1996).

#### Department of Mathematics

This Department completed 23 years of its existence in 1997. It continues to devote itself to post-graduate teaching and research in various branches of Mathematics.

**Head :** Professor H K Mukerjee

#### Faculty :

| Name and Degree                    | Designation |
|------------------------------------|-------------|
| S S Khare, PhD (Allahabad)         | Professor   |
| M B Rege, PhD (Bombay)             | Professor   |
| S K Srivastava, PhD (Gorakhpur)    | Professor   |
| H K Mukerjee, PhD (Allahabad)      | Professor   |
| P K Saikia, PhD (Wiscon)           | Reader      |
| B K Dev Sarma, PhD (IIT-Kharagpur) | Reader      |
| S L Marbaniang, MSc (Gau)          | Lecturer    |
| C R Mondal, PhD (Viswabharati)     | Lecturer    |
| A K Das, PhD (NEHU)                | Lecturer    |
| R P Shukla, PhD (Allahabad)        | Lecturer    |

#### Students Intake :

- (a) Enrolment capacity : 20  
 (b) Actual Admission : 24

| MA/M.Sc. | SC/ST | Gen   |       | Male | Female | Total |
|----------|-------|-------|-------|------|--------|-------|
|          | M - F | M - F | M - F |      |        |       |
|          | 11- 2 | 5     | 6     | 16   | 8      | 24    |

**Courses conducted :**

Linear algebra; Analysis I; Ordinary Diff Equation; Mechanics  
Analysis II; Topology; Partial Diff. Equation; Algebra I, Complex  
Function Theory; Computer Programming; Topic in Algebra; Differen-  
tial Geometry, Functional Analysis; Elementary Number Theory;  
Computer Oriented Numerical Analysis; Algebraic Topology

**Seminar/Conference etc. :**

(i) Professor M.B.Rege (a) was invited as Problem Co-ordinator and attended the 37th International Mathematical Olympiad held in Mumbai in July 1996; (b) participated in training Programmes held for Indian National Mathematical Olympiad candidates at Guwahati in August 1996 and January 1997.

(ii) Professor H.K.Mukerjee (a) visited University of Paris xi, at Orsay, and University of Paris VII at Jussieu, France for a month during January - February, 1997. He delivered talks on "Complete topological classification of homotopy type of certain standard manifolds-a survey" at Se'minaire de Topologie at Centre d'Orsay and "A survey of topological classification of homotopy type of some standard manifolds" at the Se'minaire de Topologie at Institut de Mathe'matique de Jussieu; (b) attended weekly seminars at Centre de Orsay, University of Paris, France, Institut de Mathe'matique de Jussieu, Paris France, E'cole Polytechnique at Paris, France and at the Institute of Henri Poincare' at Paris, France.

**Visiting Professors/Fellows :**

- (a) Prof R.G.Moller, University of Iceland.
- (b) Prof M.Neumann, Queen's College, Oxford University, U.K.
- (c) Prof H.D.Macpherson, University of Leeds, U.K.
- (d) Prof Malay Dutta, Gauhati University.

**Publications :**

Rege, M.B. and Chhawchharia, Sima. "Armendariz rings", Proc. of the Japan Academy, 73 series A (1997), 14 - 17.

Srivastava, S.K. "Production of Divac Particles due to riccion compling", Int. J. Theo. Phys. Vol. 35, (1996), 135 - 154.

"(1+2) dimensional model of the early universe", Int. J. Theo. Phys. Vol. 35, (1996), 171 - 188.

**Thrust Area of Research :** Pure and applied mathematics.

**Research Programmes/Projects :**

Previous years on-going - DST project on computer aided approach to differential topology.

## Department of Physics

The Department offers post-graduate education leading to M.Sc., M.Phil and Ph.D. degrees in Physics. The teaching programmes are supported by good research facilities in the areas of Laser Physics/Spectroscopy/Nuclear Physics, High Energy/Particle Physics and Solid State Physics.

**Head :** Professor C S Shastry

### Faculty :

| Name and Degree         | Designation |
|-------------------------|-------------|
| A L Verma, PhD          | Professor   |
| C S Shastry, DPhil      | Professor   |
| Y S T Rao, PhD          | Professor   |
| P Shukla, PhD           | Professor   |
| R Singh (on lien), PhD  | Professor   |
| K Kumar, PhD            | Professor   |
| Y S Jain, PhD           | Reader      |
| D T Khathing, DPhil     | Reader      |
| P N Pandita, PhD        | Reader      |
| P N Ram, DPhil          | Reader      |
| M K Parida, PhD         | Reader      |
| B M Jyrwa, PhD          | Reader      |
| P Nongkynrih, PhD       | Reader      |
| P Bajpai (on lien), PhD | Lecturer    |

### Student Intake : (M.Sc. Physics)

- (a) Enrolment capacity : 26
- (b) Actual admission : 24

| SC/ST | Gen | Male | Female | Total |
|-------|-----|------|--------|-------|
| 17    | 7   | 17   | 7      | 24    |

### Funds received (1996-97) from agencies other than NEHU/UGC

Rs.3 Lakhs from DST

### Courses offered :

Classical Mechanics, Quantum Mech-I, Mathematical Physics, Electrodynamics, Electronics, Quantum Mech. II, Nuclear Physics, Solid State Physics, Atomic & Mol. Physics, Thermal Physics, Many Body Theory, Exptl. Techniques, Solid State Physics, High Energy Physics, Laser Physics, Nuclear Physics, Project work.

### Seminar/Conference etc. :

Pandita, P.N. (a) gave two talks on "Higgs Bosons in Supersymmetric Models" at the "Golden Jubilee Workshop on Fundamental Particles and Quark Matter", Tata Institute of Fundamental Research, Mumbai (27-31 August, 1996); (b) talked on "Higgs Bosons in Supersymmetric Models" at Conference-Cum-

Workshop on "High Energy Physics and Computational Physics", Sri Guru Tegh Bahadur Khalsa College, University of Delhi (September 30 to October 13, 1996); (c) talked on "Search for Higgs Boson: Standard Model and Supersymmetry" at the "Golden Jubilee Symposium on Gravitation and Particle Physics", Physical Research Laboratory, Ahmedabad (10-14 December, 1996); (d) as Visiting Scientist in January 1997 talked on "Upper Limit on Particle Masses in Supersymmetric Models" at Deutsches Elektronen Synchrotron (DESY) Hamburg, Federal Republic of Germany; (e) talked on "Search for Higgs Boson: and Supersymmetry" at Universitat Kaiserlautern, Federal Republic of Germany, (February 4, 1997); (e) as Visiting Scientist, Feb./March, 1997 gave invited talk on "Search for Higgs Boson: Standard Model and Supersymmetry" at the Helsinki Institute of Physics, University of Helsinki, Finland; (f) as Visiting Scientist (5-20 March, 1997) invited talk on "Higgs Boson Mass in the Standard Model and Supersymmetry" at the University of Bergen, Norway.

Parida, M.K. was invited to talk on "Statics of Non SUSY Grand Unified Theories" and acted as Rapporteur/Convener in the session "Super Symmetry and Unification" at the XII DAE High Energy Physics Symposium Dec. 26, 1996-Jan 1, 1997 at Guwahati University.

Parida, M.K., Deys, S., and Purkayastha, B., "How to get  $SU(2) \times SU(2) \times (SU(4) \text{ breaking intermediate scale in SUSY } SO(10))$ ," Proc. XII DAE HEP Symp. Vol. 1, p63 (1996).

Parida, M.K. and Singh N.N., "Low energy seesaw formulas for neutrino masses in Unified supersymmetric models", Prof. XII DAE HEP Symp. Vol. 1, p66 (1996)

Verma, A.L. delivered talk on (a) "Photophysical Processes in Porphyrin at the School of Science, Kwansai Gakuin University, Nishinomia on 18th November 1996; (b) "Photo-Oxidation and Electron Transfer in Porphyrins Probed by Resonance Raman Technique" at the Institute for Molecular Sciences, Okazaki, Japan on 20th November, 1996; (c) "Photo-oxidation of Porphyrins Monitored by Raman Technique" at the Kanagawa Academy of Science & Technology, Kawasaki, Japan on 6th December, 1996; (d) "Photo-Oxidation and Electron Transfer in Porphyrins" at the Kyoto University, Kyoto on 12th February, 1997; (e) "Photophysical Processes in Porphyrins Probed by Raman Spectroscopy" at the Hiroshima University, Hiroshima on 31st January, 1997.

#### Publications :

Ananthanarayan, B. and Pandita, P.N. "Particle Spectrum in the Non-Minimal Supersymmetric Standard Model with  $\tan \beta$ " Phys. Lett. B371 245-251 (1996)

Chaudhury, N.K., G.S.S. Saini and A.L. Verma, "Temperature Dependent Axial Ligation Changes and Photoreduction of Iron Protoporphyrin-IX Dimethyl Ester Chloride at Low Temperatures Monitored by Resonance Raman Technique", Chem. 34, 346-349 (1995).

Kileng, B., Osland, P. and Pandita P.N. "Production and Two-Photon Decay of the MSSM Scalar Higgs Bosons at the LHC" Zeitschrift für Physik C71: 87-94 (1996).

Nongkynrih, P., Dkhar, P.S. and Khathing D.T. "Micronutrient Elements in Acid Alfisols of Meghalaya under Rice Cultivation" Jour. Ind. Soc. of Soil Science 44, 455-457 (1996).

Parida, M.K. and Rani, Merostar, "Radiative Correction and Uncertainties in Seesaw Formulas for Neutrino Masses", Phys. Lett B377 89-93 (1996).

Parida, M.K. and Usmani, A. "Quark-lepton Yukawa Unification at Lower Mass-Scales" Phys. Rev. D54, 3363-3366 (1996).

Shastry, C.S. and Susan, P. "Analysis of resonances in heavy ion reactions as barrier region resonances", Ind. J. Phys. 70A, 63-68 (1996).

Sahu, B. and Shastry, C.S. "Cross Section, Spin distribution and mean spin analysis of heavy ion fusion by closed formulae", J. Phys. G. Nucl. Particle Physics 22, 1483-1495 (1996).

Shastry, C.S. and Nandi, S. "Concept of Time in Physics", in Horizons in Physics II, Ed. N. Nath and A.W. Joshi New Age International Ltd. p.40-61 (1996).

Shukla, P. "Hysteresis in an Ising Chain with Quenched Random Disorder" Prog. Theo. Phy 96:pp 69-80 (1996).

Shukla, P. "Exact solution of zero-temperature hysteresis in a ferromagnetic Ising chain with quenched random fields" Physica A 233:pp242-252 (1996).

Shukla, P. "Renormalization group", in Bhattacharjee, S.M. (ed) Models and Techniques of Statistical Models and Techniques of Statistical Physics, pp 77-101, Narosa Publishing House, New Delhi (1997).

Shantha, P.K. and Verma, A.L. "Resonance Raman Characterization of Oxo-Ferryl Tetraphenylporphyrin Formed during Photodisproportionation of (FeTPP)<sub>2</sub>o in Detergent Micelle at Room Temperature" Inorg. Chem 35, 2723-2725 (1996).

#### **Thrust Area of Research :**

Nuclear Physics, Laser Physics, Solid State Physics, and High Energy Physics.

#### **Research Programmes/Projects :**

Dr. P. N. Pandita:

(i) "Supersymmetry with Extended Gauge Groups" (Department of Science and Technology) and (ii) "Supersymmetric Grand Unification" (Department of Atomic Energy).

Dr M K Parida:

"Unification of fundamental forces-New predictions and Phenomenology" (DST).

Dr P Shukla:

"Statistical Mechanics of Neural Networks" (DST).

Dr.K.Kumar:

He has taken up investigations on the complex molecules containing benzene ring and also vibrational relaxation process using Raman Spectroscopy and a paper entitled "Vibrational relaxation studies in p-methyl acetophenone" was accepted for presentation in National laser symposium, Feb 6-8, 1997 held at CAT, Indore.

Dr.B.M.Jyrwa:

Continued active collaboration with IAEA Vienna and BARC, Bombay on analysis of nuclear data and relating statistical errors to optical model parameters.

Dr A L Verma:

"Laser-Induced Photophysical Processes in Porphyrins Monitored by Resonance Raman Technique" (DST).

#### **Other Activities :**

(i) Professor R.Singh has joined Delhi University as Professor in Department of Physics in January.

(ii) Dr.P.K.Bajpai has joined as Reader & Head, Department of Physics Ghasi Das University, Bilaspur in February.

(iii) Dr.P.N.Pandita was National Programme committee Member, "XII DAE Symposium on High Energy Physics", Gauhati University 26 December 1996 to 1 January 1997.

(iv) Dr.P.N.Pandita was selected speaker under Theoretical Physics seminar Circuit, DST, New Delhi for the period 1996-98.

(v) Dr.M.K.Parida got Associate Membership of ICTP, Trieste, Italy for a period of 2 years.

(vi) Professor C.S.Shastry visited Tripura University during February 1997 as a member of IX Plan UGC Visiting team.

(vii) Professor A.L.Verma visited the Kwansai Gakuin University School of Science 662 Nishinomia, Japan as Visiting Professor from August 1996 to March 1997. He attended the 71st Annual Meeting of the Japanese Chemical Society on Molecular Structure and Spectroscopy from 5th to 8th October, 1996 at the Kyushu University, Fukuoka, Japan and the 22nd Annual Meeting on Liquid Crystals from 5th to 8th October, 1996 at the Kyushu University, Fukuoka, Japan.

(viii) Professor P. Shukla visited International Centre for Theoretical Physics, Trieste, Italy during April September 1996 as Senior Associate.

(ix) Professor C.S. Shastry attended the Patent Awareness Workshop organised by DST at University of Hyderabad during September 1996.

### Centre for Science Education

The Centre was created in 1985 with the object to develop scientific temper and spirit of enquiry amongst the younger generation, to identify and cultivate their creative talent, and to take the message of science and technology to masses and rural areas, by rural women.

**Head :** Dr Man Mohan Singh

#### **Courses Conducted :**

Non-formal Course on Computer Appreciation - 4 months' duration; Basic programmes - 14 weeks ; Special course on Microsoft windows - 12 weeks. Course on amateur radio - 12 weeks; Remedial Teaching in Botany, Chemistry, Mathematics, Physics and Zoology.

#### **Other Activities :**

Like other years the Centre participated as well as organised various short term programmes in conformity with the long term plan perspective of the Centre under its various streams. Programmes on the popularization of Science and Mathematics through demonstrations, the National Science Day celebration, Science fairs at Imphal and Kohima, Community awareness programmes, popular and extension lectures in schools and village level camps were organized successfully.

#### **Seminar/Conference etc. :**

Dr Man Mohan Singh (a) was invited as Resource Person in the Workshop on Environment Education organised by Department of Education from 19th to 21st June, 1996, and delivered a lecture on "Play way method of imparting Environment Education"; (b) was invited to the National Convention on Vocationalisation of Computer Education organised by Computer Centre, Aligarh Muslim University Aligarh from 28th to 30th September, 1996, and contributed a paper on "Computers as an aid to Education and Necessity for Vocationalisation"; (c) served as a Resource Person during training-cum-workshop on Use of Puppet for Science and Technology Communications at PUNE organised by the Peoples' Universal Puppetry Educational Theatre from 24th November to 4th December, 1996.

## Research Programmes/Projects :

- a) Training-cum-Development of Reflective Telescopes for N.E.States including Sikkim sponsored by NCSTC, Dept. of Science & Technology Govt. of India has been completed.
- b) Preparation of Comprehensive Annotated Bibliography of popular literature and multimedia softwares in Science & Technology in Nepali language, approved and sanctioned by Dept. of Science & Technology, Govt. of India.
- c) Design Development and Installation of participatory Discovery Exhibition at Kohima sponsored by State Department of Science & Technology Kohima - approved. A sanction of Rs.2.50 lacs was received. The proposal to establish the Discovery Science Centre has been implemented.

## Other Matters :

1. The Centre's evolved MANAR CONSORTIUM- Meghalaya Initiative project as an outcome of Bharat Jana Gyan Vigyan Jatha continued its activities during the year. It supported fully the workshop on use of Electronics Kit and So 101 Experiments for Teachers of N.E.
2. Centre received numerous request from different Govt. Organisations and Non-Govt. volunteer organisations for providing participation from N.E. in their programmes. Accordingly Centre procured sponsorship for 10 participants to depute them to various trainings organised at PUNE, Barapani, Guwahati and Hyderabad. Further, the Centre offered a set of 10 Discovery Science Exhibits and Mirror Exhibits (Public Model) for permanent display at State Museum of Manipur at Imphal.
3. Dr. Man Mohan Singh received the "National Award for Popularisation of Science among Children" from the National Council for Science Technology Communications, Department of Science and Technology, Govt. of India, for best efforts during the period 1991-96.