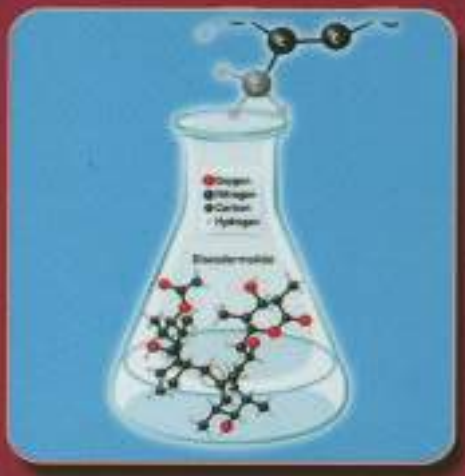
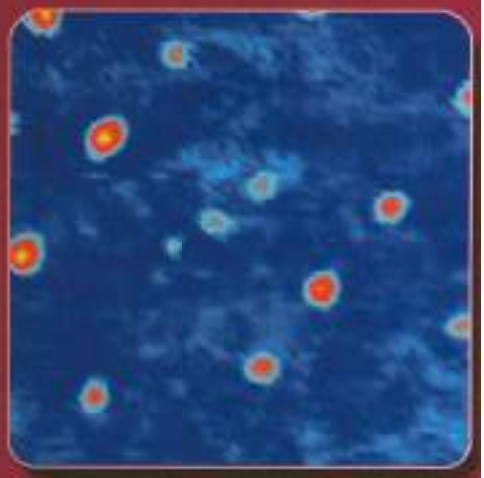
ANNUAL REPORT

2010-11





INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

(AN AUTONOMOUS INSTITUTE UNDER THE DEPARTMENT OF SCIENCE & TECHNOLOGY,GOVT. OF INDIA)

VIGYAN PATH, PASCHIM BORAGAON, GARCHUK, GUWAHATI, ASSAM

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Institute of Advanced Study in Science and Technology
(An Autonomous Institute under the Department of Science and Technology, Govt. of India)
Vigyan Path, Paschim Boragaon, Garchuk, Guwahati, Assam, India

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FROM DIRECTOR'S DESK

The Institute of Advanced Study in Science and Technology (IASST) is the only autonomous, multidisciplinary research organization under the Department of Science and technology (DST), Government of India in the whole North Eastern region of the country. The Institute was taken over by DST on 9th March, 2009. Before that the Institute had to work for two decades under very trying conditions which was made worse by constant financial worries. A financially viable research Institute equipped with adequate scientific manpower and infrastructure can provide the atmosphere of research on emerging areas and build up it as a Centre of Excellence.

The generous funding of DST for last few years has enabled us to develop some infrastructural facilities although our research works always used to depend on sponsored projects. IASST has been carrying out research activities in different selected fields of pure and applied science with a view to enlarging the frontiers in these fields.

To promote this pioneering research institute as a Centre of Excellence it requires all around developments of proper laboratory facilities with required sophisticated instruments and dedicated qualified human resources.

During the last year, several new programmes in both basic and applied research have been undertaken and accomplished successfully. These programmes include Charging of micrometer sized dust grains in a low temperature and low density plasma produced using a magnetic filter, Investigations of hydrophobic and scratch resistance of Polystyrene films on bell metal by RF plasma discharge, Development of organic Photovoltaic device, RF Argon treatment on Muga Fibre, Development of liquid crystalline polymers for fabrication of Thermistor device, Metal nano-particles anchored to bi-functionally capped CdS nano-crystals, Synchronization of Moth Emergence using Photo periodic effect, Hydrolipidermic and Antiatherosclorotic effect of dried pulp of indigenous fruits, Study of

watermites of India with new records, Impact of paper mill effluent on growth of crops. Studies of Sequence Spaces, Series, Stochastic processes, Image processing are also going on parallely. Details of all these research activities, the results and publications are described in this Annual Report.

I am very much grateful to the Governing Council (GC), Scientific Advisory Council (SAC), Finance Committee (FC) and Building Committee (BC) which are the channels for taking major decisions on important matters of the institute for its growth and development.

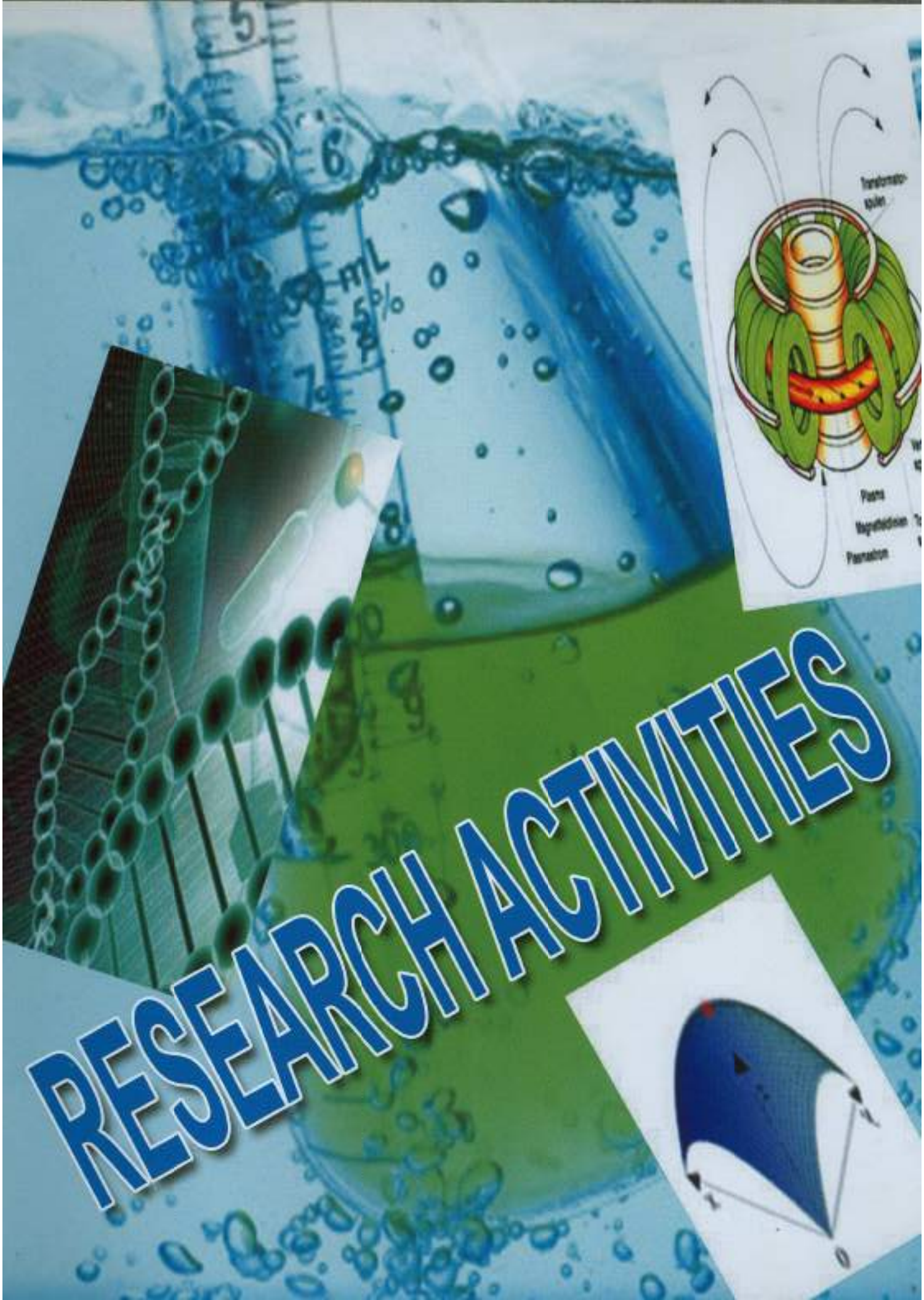
This year the SAC has approved an institutional project entitled **"Upgrading of Infrastructure Facilities for Advanced Research at IASST"** and the proposal includes two parts: (i) To Study Biological and Physicochemical Properties of Muga Silkworm and Silk, (ii) To Develop Advanced Functional Materials from Silk and Other Polymers for various applications e.g, Solar Cell, Thermistors, Sensors, Fuel Cell and Stimuli responsive surfaces etc. If the project is sanctioned, the scientists can take up high quality research activities in some new and challenging areas.

At this juncture, infusion of young talents with international perspective could provide the push that the institute needs so urgently.

I take this opportunity to offer my sincere thanks and best wishes to all faculty members, research students and administrative staff for trying their best possible ways to make this institute an attractive centre of research in this region.

I am also thankful to the Editorial Board for preparing this Annual Report. Wishing all of them great success.

Joyanti Chutia
Director, IASST


RESEARCH ACTIVITIES

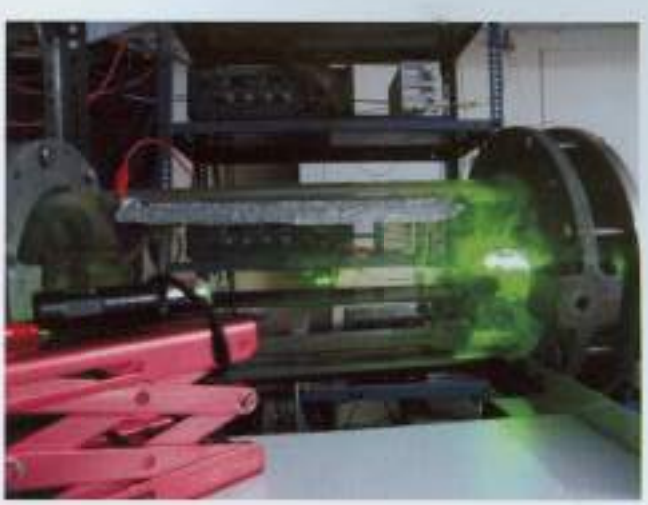
1.Material Sciences Division

Material Sciences Division has been established in the year 2002 by inclusion of the then existing *Plasma Physics Division* and a new unit, *Polymer Science* with an aim to broaden the field of advanced research on materials science at IASST. The Plasma Physics unit of the Material Sciences Division has been engaged in few thrust areas of basic plasma research and plasma processing. In polymer section, research work on liquid crystalline polymers and devices, nanomaterials of metals, semiconductors, inorganic, organic, polymer, polymer composites and hybrid materials is being done. The aim is to develop a comprehensive chemical methodology leading to a systematic bottom-up fabrication of nanoscale electronic and optoelectronic devices.

1.1. Plasma physics unit

In the plasma physics unit both basic and applied plasma research is being carried out. Nonlinear phenomena e.g. ion acoustic wave and sheath phenomena, waves and instabilities have been investigated in multicomponent as well as in dusty plasma. Effect of ion beam, electron temperature and plasma density on nonlinear phenomena are also observed. Low density and low temperature plasma produced by magnetic filter, has been used for production of electron free, negative ion-positive ion plasma and for lower earth orbit simulation.

Research scholars working for the development of organic solar cell



Radio frequency Dusty Plasma Set up at IASST

Research work on plasma processing has been done with a motivation to utilize plasma technology in protective and decorative coatings as well as in the development of organic material based energy devices. Development of prototype organic solar cell has been done by plasma based deposition process. Synthesis of proton exchange membrane for hydrogen fuel cell by plasma process is another active area of research. Plasma processing has also been utilized for treatment of Muga fibers for value addition.

1.1.1. Charging of micron size dust grains in low temperature and low density plasma produced using a magnetic filter

A magnetic filter plasma source has been designed to produce a low electron temperature and low electron density plasma volume (Fig. 1.1.1-1.1.3). The parameters T_e and n_e are found controllable within a certain range by adjusting the discharge condition in the source. Charging of micron size dust grains in such plasma has been investigated. Measured average charge on a dust grain (few hundred electrons) is found to increase in presence of an external magnetic field (< 150 Gauss) as shown in Fig. 1.1.4.

Discharge is made only in the plasma source and the source plasma parameters can be effectively maintained to obtain the plasma with low T_e (~ 0.15 eV) and n_e (~ 10^6 cm^{-3}) value in the target. The transverse magnetic field configuration of the magnetic filter placed between the source and target plasma is found effective in confining the primary and energetic

electrons in the source. The I-V characteristics drawn in the target plasma and the measured EEDF demonstrate clearly that only low energy electrons and ions are diffused through the filter into the target. Measurements on charging of dust grains in such low T_e and n_e plasma have been performed. Measured minimum value of average charge on a dust grain is ~500e which is close to the observed ionospheric data (~100e). An axial magnetic field is found capable of enhancing the average dust charge. The device has flexibility to produce near ionospheric plasma environment by optimizing the magnetic field topography of the filter and source discharge conditions.

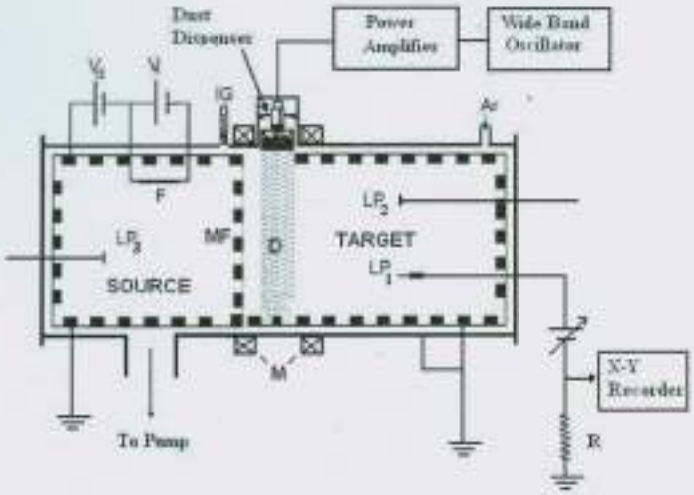


Figure 1.1.1. *Schematic diagram of the experimental set up. LP : Langmuir probe, MF: magnetic filter, M: Helmholtz coils, D: dust region, F: filament, IG: ionization gauge, V_f : filament power supply, V_d: discharge power supply.*

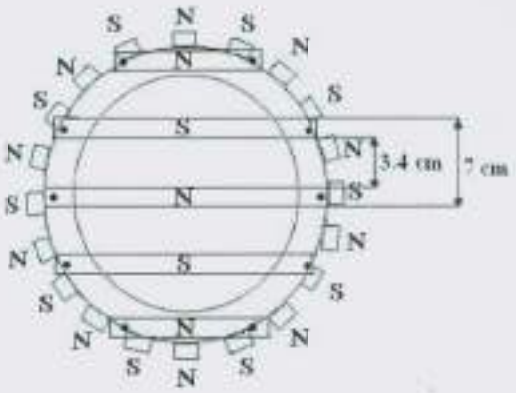


Figure 1.1.2. *Schematic diagram of the magnetic filter. 5 parallel magnets with alternate pole orientation form the magnetic filter. Gap between each pair of magnets of the filter is 3.4 cm. 20 magnets around the circular perimeter form the surface cusp field.*

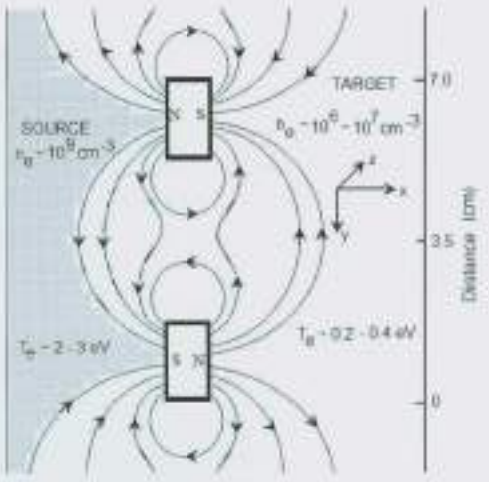


Figure 1.1.3. *Schematic of the magnetic field lines near a pair of magnets of the magnetic filter.*

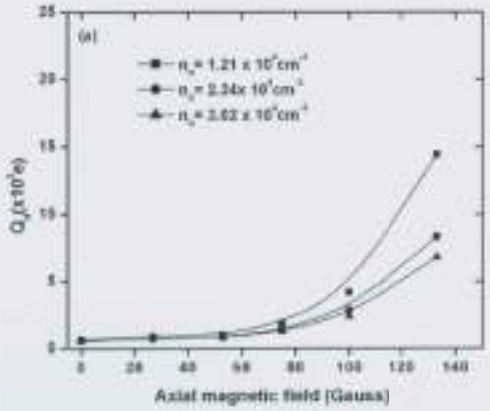


Figure 1.1.4. *Measured average charge on a dust grain with increasing magnetic field with dust density as a parameter. Source discharge current (a) 100 mA and (b) 200 mA.*

1.1.2. Investigation on sheath formation in low temperature and low density plasma:

The sheath formation in low temperature and low density plasma has been investigated in a linear plasma device shown in Fig. 1.1.5. This investigation is of great importance because of the fact that the plasma parameters are very close to the ionospheric plasma. We have examined an ion rich sheath applying negative bias to a stainless steel plate 20 mm in diameter inserted into the plasma. The plasma potential is measured in front of the plate axially using an emissive probe. Measured potential profiles are shown in Fig. 1.1.6 for two different plate bias voltages. The Bohm sheath criterion is valid for the plasma and as expected the sheath has larger thickness which increases with increasing negative bias voltage.

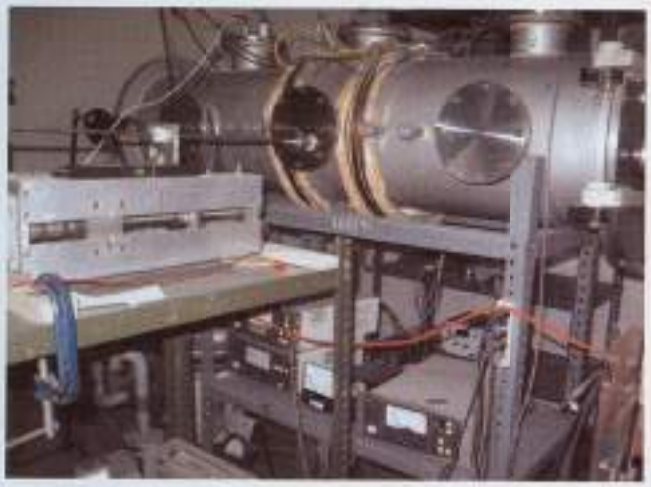


Figure 1.1.5 *Photograph of the low temperature plasma device.*

In negative ion positive ion plasma, however, the sheath structure shows a peculiar behaviour with increasing negative ion concentration. An ion rich sheath shows initial decrease in the sheath potential (measured in axial locations) and expansion of the sheath thickness with increasing negative ion concentration.

However, beyond a critical value of the negative ion concentration, the sheath thickness becomes smaller. A typical sheath profile with increasing negative ion concentration is shown in Fig. 1.1.7. Measured sheath potential at X = 1 cm and 2 cm from the negatively biased plate are shown in Fig. 1.1.8.

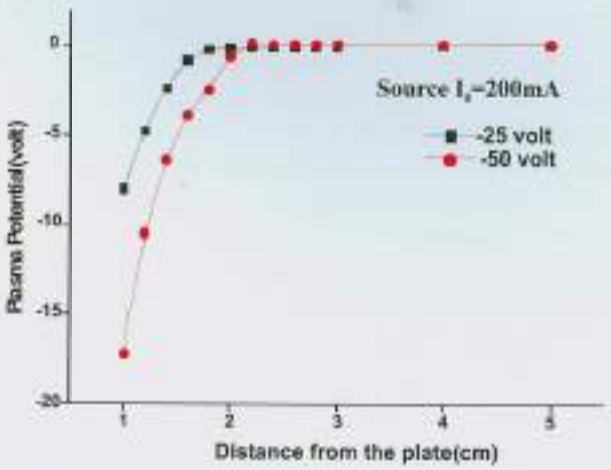


Figure 1.1.6. *Measured axial potential profile starting at 1 cm from the plate in Ar plasma with plate baising voltage -25 V and -50 V. $n_e \sim 10^7$ cm^{-3} and $T_e \sim 0.2$ eV.*

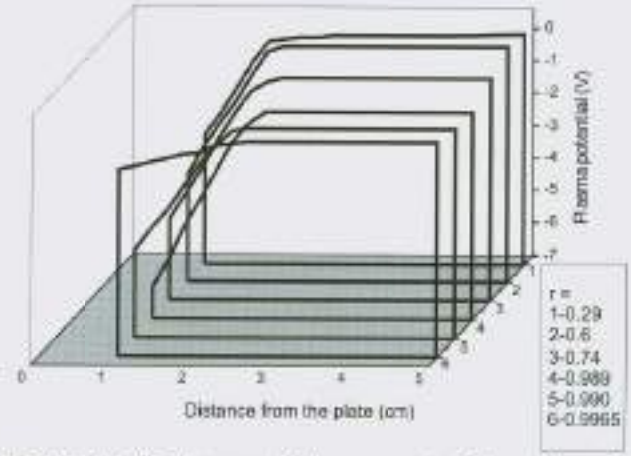


Figure 1.1.7. *Measured plasma potential profile with plate biasing voltage -25 V and negative ion density ratio as a parameter. $n_e \sim 10^8$ cm^{-3} (for Ar only) and $T_e \sim 2.0$ eV.*

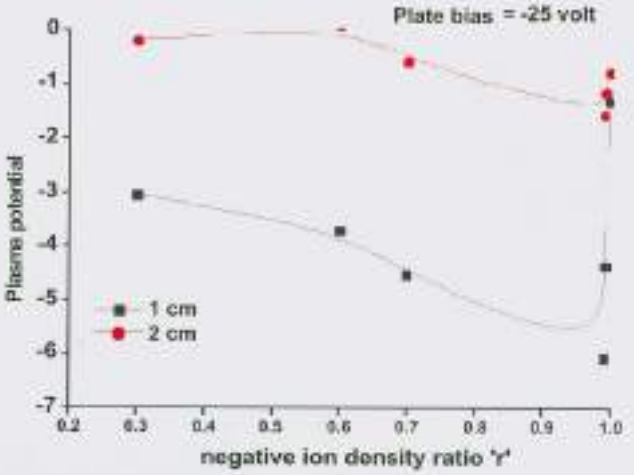


Figure 1.1.8. *Measured potential inside the sheath at 1 cm and 2 cm from the plate with increasing negative ion density ratio.*

Theoretically sheath has been investigated by many workers in positive ion negative ion plasma and it has been shown that sheath potential decreases sharply at a critical concentration of negative ion. However, experimental observation shows that sheath potential decreases rather slowly, reaches a minimum at a critical concentration and increases again for higher negative ion concentration. The physical mechanism of this behaviour of sheath is not clearly understood at present and a detailed study is in progress.

1.1.3. Effect of $E \times B$ electron drift and plasma discharge in dc magnetron sputtering plasma

Study of electron drift velocity caused by $E \times B$ motion is done with the help of a Mach probe in a dc cylindrical magnetron sputtering system at different plasma discharge parameters like discharge voltage, gas pressure and applied magnetic field strength. The interplay of the electron drift with the different discharge parameters has been investigated. Strong radial variation of the electron drift velocity is observed and is found to be the maximum near the cathode and it decreases slowly with the increase of radial distance from the cathode. The sheath electric field, E measured experimentally from potential profile curve using an emissive probe is contributed to the observed radial variation of the electron drift velocity. The measured values of the drift velocities are also compared with the values from the conventional theory using the experimental values of electric and magnetic fields. This study of the drift velocity variation is helpful in providing a useful insight for determining the discharge conditions and parameters for sputter deposition of thin film.

Variation of the electron $E \times B$ drift velocity in radial direction is estimated in the cathode sheath region of a direct current cylindrical magnetron sputtering device using a planar Mach probe. In the radial direction, the drift velocity gradually decreases from the cathode centre toward the anode region where the velocity becomes minimum. The measured potential profile using emissive probe indicates that the sheath dimension is nearly a few tens of Debye length. The observed drift also mainly occurs within the cathode sheath region. The $E \times B$ effect on electrons is effective mainly near the cathode region due to the higher strength of radial electric field. The drift velocities of electrons calculated both from Mach probe characteristics and E/B method accord well with each other all throughout. The estimated drift velocity helps to understand the electron distribution in the magnetron sputtering device and determines the appropriate discharge conditions and plasma parameters for deposition process of thin films.

1.1.4. Investigations on dusty plasma crystal (Shear wave propagation in a dusty plasma crystal)

Dusty plasma provides unique opportunity to explore a variety of collective plasma processes. In the strongly coupled regime, dusty plasma can spontaneously form ordered (crystalline) structures, so called plasma crystal. Dynamical properties of longitudinal and transverse mode featuring in such strongly coupled Coulomb systems have been a subject of intense study. We have investigated the excitation and propagation of shear wave in a plasma crystal formed in a rf discharge plasma. Argon plasma is produced in a cylindrical glass chamber 50 cm in length and 18 cm in diameter at pressure ~ (3×10^{-3} 8×10^{-2}) mbar by applying rf power 6-15 W between the two outer electrodes (Fig. 1.1.9). Silica microparticles (5 μm diameter) dispersed into the plasma are levitated in the sheath just above a conducting plate kept inside the chamber. Typical plasma parameters measured with the help of a stainless steel planar Langmuir probe (6mm diameter) are

Figure 1.1.9. *Experimental setup for crystal formation in dusty plasma*

electron density~10^8~10^9cm^{-3}, electron temperature ~ 5 - 7 eV, charge of the dust particle ~ $4x10^4$ e, where e is the electronic charge. Plasma crystal is formed in the sheath above a grounded plate placed inside the plasma volume when the coupling parameter $\Gamma >> 1$. Dust particles in the sheath are illuminated by using a green laser sheet and recorded by using a high speed digital camera. A low frequency (1 Hz - 20 Hz) sinusoidal signal (~$10V_{pp}$) is applied to a small rectangular region (0.5 cm x 15 cm) of the plate which is insulated from the rest of the plate. This part of the plate acts as an exciter. The variation in the sheath height above the exciter due to the externally applied ac signal excites a propagating shear wave. The characteristics of the wave are measured by analyzing the recorded video.

Figure 1.1.10. *Snapshot of the dusty plasma crystal undergoing oscillation at 1 Hz.*

Figure 1.1.11. *Snapshot of the dusty plasma crystal undergoing oscillation at 4 Hz.*

Phase transition in strongly coupled dusty plasma

The transition of highly disordered state of charged microparticles into a Coulomb Crystal has also been studied by varying the neutral gas pressure. The temperature of the dust particles measured at this stage is found to be ~ 19 eV which is significantly higher than the plasma ions and electrons. With increasing neutral gas pressure, the dust temperature reduces which helps to build up a strong correlation between the particles, showing liquid like phase. Figure 1.1.10 and 1.1.11 represents the crystal formation at frequencies of 1 Hz and 4 Hz respectively. Crystal formation is observed when the gas pressure is raised beyond a critical value. However, for the reverse process i.e. from crystal to liquid phase, which is achieved by reducing the gas pressure, the transition occurs at a lower pressure than that observed for the forward process i.e. from liquid to crystal.

1.1.5. RF Argon plasma treatment on Muga silk fiber to enhance its mechanical strength and hydrophobicity

This research work has been carried to improve the hydrophobicity and tensile strength of muga silk fiber. Muga silk fiber is a protein based natural silk fiber having several unique properties than any other natural silk like natural golden color, Anti-septic properties, high durability, flame retardance, Anti-bacterial properties, high thermal stability etc. These unique properties promote muga silk in research field for further improvement and future application in biomedical as biomaterials, bioelectronics, decorative items and also for upgrading the quality of the textile.

To fulfill the motivation of this work Ar plasma treatment on this fiber is chosen because plasma treatment is an environment friendly way to modify only surface properties without destroying its bulk properties. The Ar plasma treatments are carried out at working pressure of 1.2×10^{-1} mbar and with the variation of applied RF power (10-30 W) as well as treatment time (5-20 minutes). Characterization of the properties like chemical composition, thermal stability of the virgin and Ar plasma treated muga silk fibers has been done with the help of FTIR, DSC and TGA analyses.

From FTIR analysis as shown in Fig. 1.1.12 no significant change in the peak intensity is observed in the wave number region of 1800-900 cm^{-1} for all the plasma treated muga silk fibers (RF power range: 10-30 W and treatment time range:

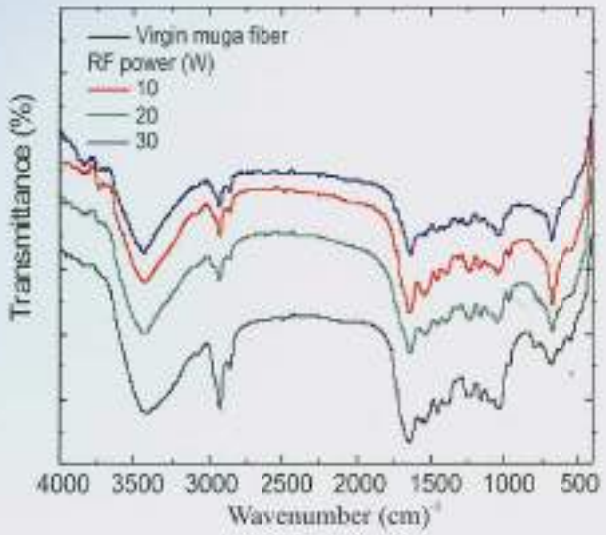


Figure 1.1.12 *FTIR analysis spectra of virgin and Ar plasma treated muga fiber at treatment time of 10 minutes.*

5-20 minutes) in comparison to the virgin one. This indicates that in the present work the Ar plasma treatment does not significantly affect the chemical composition of muga silk fiber. Thermal properties of treated and untreated muga silk is studied using DSC and TGA analysis and results are presented in Fig. 1.1.13 and 1.1.14. DSC and TGA results of untreated and treated muga silk are almost similar in nature which reveals that after Ar plasma treatment the thermal stability of the fiber remains unchanged.

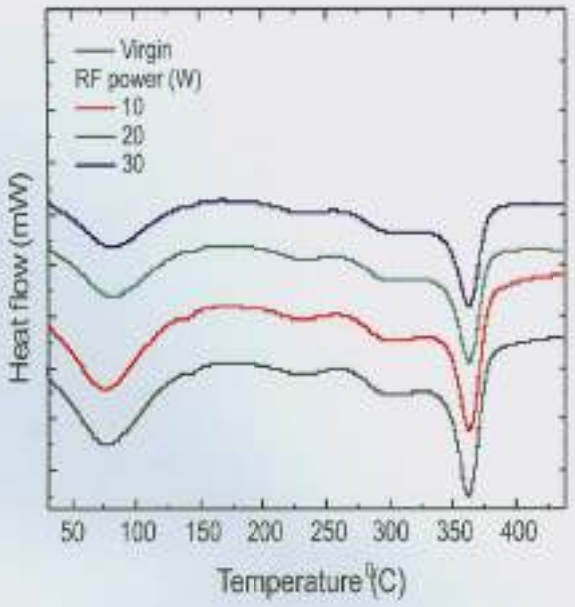


Figure 1.1.13. *DSC curves for virgin and Ar plasma treated muga fiber at treatment time of 10 minutes.*

Surface morphology of the muga silk has been investigated using scanning electron microscopy. Figure 1.1.15 shows the SEM micrographs of untreated and argon plasma treated muga silk fibers. SEM images reveal that due to Ar plasma

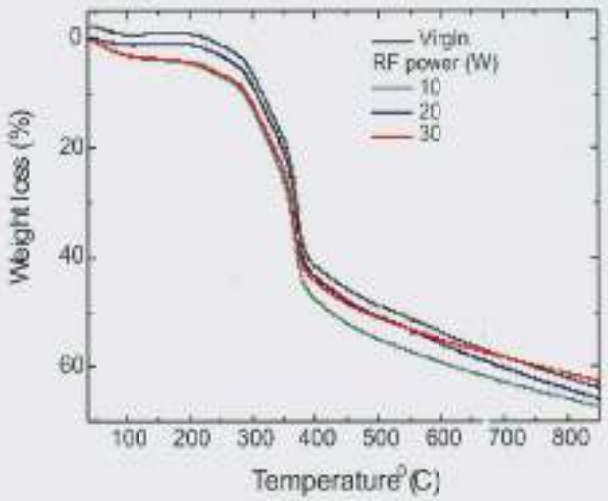


Figure 1.1.14. *TGA curves for virgin and Ar plasma treated muga fiber at treatment time of 10 minutes.*

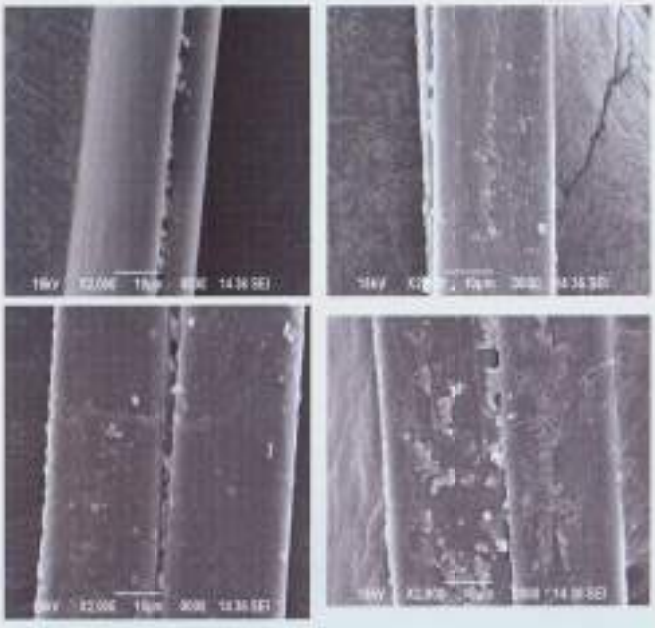


Figure 1.1.15. *SEM images of (a) Virgin and (b), (c), (d) Ar plasma treated muga fiber at various RF power and treatment time of 10 minutes.*

treatment the surface morphology of the fiber gets changed, this is due to the etching effect by energetic ions on outer surface of the sample. The micro roughness which occurs on the sample contributes to enhance the water contact angle.

RF power(W)	Treatment time (Minutes)	Maximum tenacity (MPa)	Contact angle (°)	Surface energy (mJ/m^2)
0	0	454	100	12.56
10	5	426	115	6.94
20	5	455	117	6.75
30	5	483	111	8.23
10	10	525	77	27.16
20	10	549	85	21.68
30	10	442	97	14.21
10	15	431	100	13.15
20	15	332	112	10.93
30	15	426	103	10.79
10	20	327	81	24.35
20	20	268	94	16.17
30	20	252	106	11.54

Table 1.1.1. *Variation of tenacity and wettability as a function of treatment time and applied RF power.*

At optimized discharge parameters, RF Ar plasma treated muga silk fibers show enhanced wettability and tensile strength at treatment time of 5 minutes and 10 minutes with RF power of 20 W as compared to the untreated one as well as those treated at other treatment times (5,15 and 20 minutes) and RF powers (10 and 30W) (Table 1.1.1). However at higher treatment time and RF power, the so observed properties of the treated muga fiber deteriorate. Hence plasma treatment is one of the best ways to modify the surface properties of this material without destroying its bulk properties.

1.1.6. Deposition of conducting polymer films and development of nanocomposite material based bulk heterojunction organic photovoltaic device by hybrid plasma deposition process

Plasma polymerization of aniline has been carried out at a working pressure of 1×10^{-1} Torr in radiofrequency plasma to deposit conducting polymer films and the effect of polymerization time is investigaed on the structural, optical and optoelectronic properties of deposited films. Conjugated structures of polyaniline films are obtained with unique and broad optical absorption band in the ultraviolet and entire visible region. The width of the absorption band increases and hence the optical band gap decreases with polymerization time Figure 1.1.16 (a) shows the plots of $(\alpha h\nu)^2$ versus the photon energy $h\nu$ for different polymerization times. The optical band gaps are obtained from the extrapolation of the plot $(\alpha h\nu)^2$ vs $h\nu$ at $(\alpha h\nu)^2$ equals 0. The optical band gap decreases from 2.95-2.28 eV with increase in polymerization time, which is clear from the red shift of the absorption edge with polymerization time. The increase in cross link and as well as chain length favors the reduction of optical gap with polymerization time.

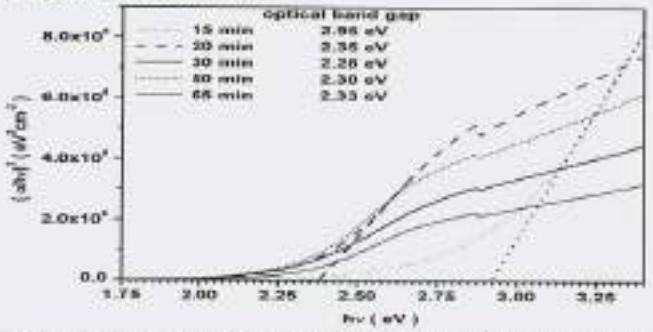


Figure 1.1.16.(a) *Plot $(\alpha h\nu)^2$ versus photon energy of rf plasma deposited polyaniline films with different polymerization time.*

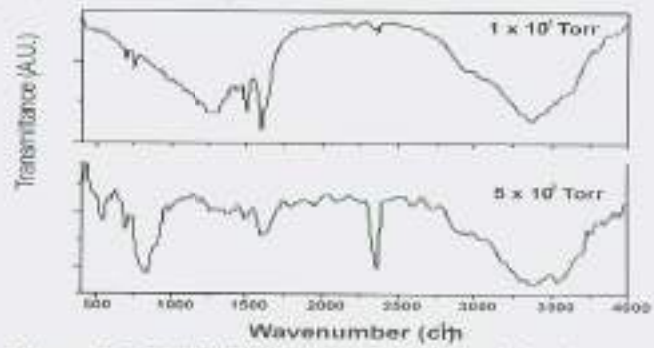


Figure 1.1.16.(b) *FTIR spectra of Pulsed dc plasma deposited Polyaniline.*

Deposition of Polyaniline films have also been carried out with continuous wave rf (CWRF) as well as pulsed dc plasma and a comparative study has been made. Figure 1.1.16.(b) represents the FTIR spectra of pulsed plasma deposited Polyaniline at two different working pressures. At lower pressure (2×10^{-2} to 5×10^{-2} Torr):

- At higher power, > 25 W both CWRF and Pulsed plasma could not retain the benzenoid ring. Pulsed plasma deposition rate is higher at this power level.
- Ring retention is more prominent in case of pulsed plasma at a power range of 18-20 W with a duty cycle of 55% and repetition frequency of 50 kHz.
- In case of CWRF ring retention is observed in the power range of 8-12 W. However, in presence of argon breaking of benzenoid units occur due to energetic argon ion bombardment.

Protonation has been done on the film deposited by pulsed plasma technique. Improvement in the crystallinity has been observed in the Polyaniline after HCl doping as revealed from the results of X-ray Diffractometry analysis shown in Fig. 1.1.17.

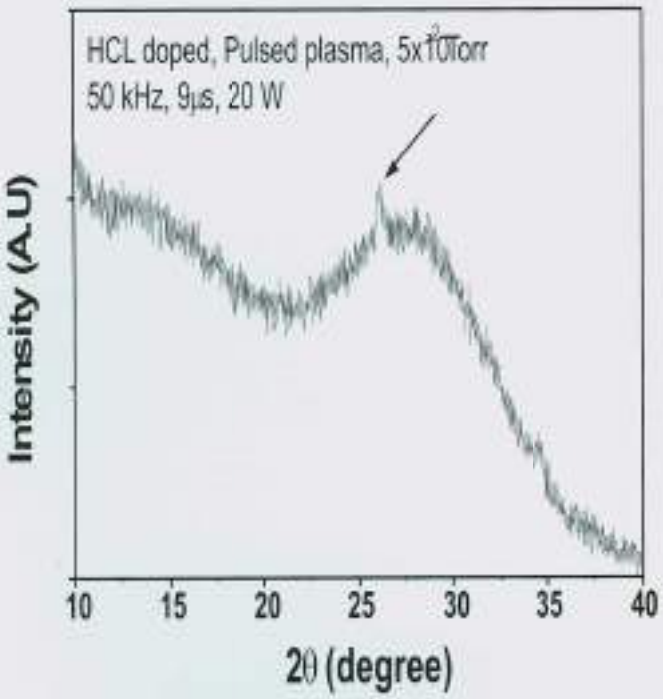


Figure 1.1.17. *XRD pattern of pulsed plasma deposited HCL doped Polyaniline showing enhanced crystallinity.*

Synthesis of conducting polymer composite films:

The applicability of magnetron sputtering and plasma polymerization combined process for synthesis of nanocomposite films of metal oxide/conducting polymer has been investigated at different pressure ranges of 5×10^{-2} Torr to 5×10^{-3} Torr. Deposition of composite film of TiO_2 /Polyaniline carried out at a pressure of 5×10^{-2} Torr shows that sufficient amount of organic content can be retained at this pressure level. It has been observed that the amount of TiO_2 incorporation in the film may be controlled by varying the working pressure level.

Discharge characteristics and correlation with film properties:

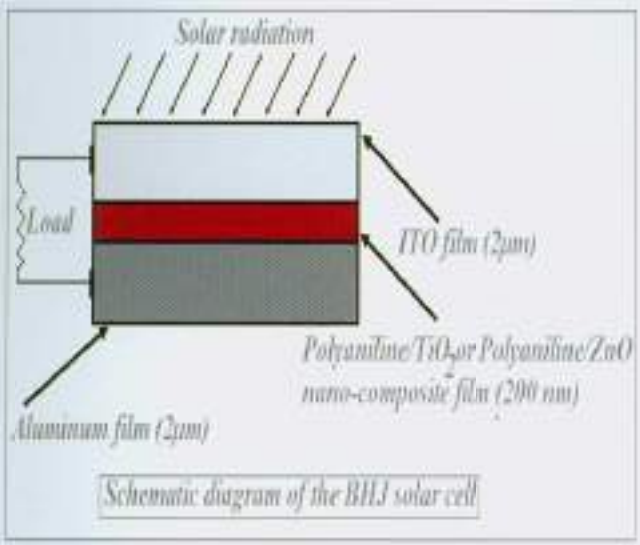
Discharge characteristics as studied using Langmuir probe and optical emission spectroscopy reveals that deposition of conducting polymer films requires a very soft plasma process where electron temperature and ion energy plays a very crucial role. Low electron temperature (2-3 eV) and ion energy in the range of 25 eV to 90 eV, depending upon the pressure range, are suitable for good quality conducting polymer films using rf plasma. Moreover, reverse time is found to play a vital role in case of pulsed plasma deposition of conducting polymers.

Study of thermal stability of the films:

Plasma polyaniline is found to exhibit greater thermal stability. The thermogravimetric analysis (TGA) of plasma-PANI has been carried out in air and argon atmosphere. The first weight loss (2 % at 120 °C) occurs due to the moisture evaporation. The second weight loss occurs in the region 130 530 °C, where the stability is enhanced with polymerization time, could be due to the aliphatic contents in the film. The final and major weight loss occurs in the region 530 800 °C where the polymer undergoes structural decomposition.

Development of Organic photovoltaic device:

An organic/inorganic nanocomposite material based photovoltaic device has been developed by combined process of plasma polymerization and magnetron sputtering. The schematic diagram and photograph of the device is presented in Fig. 1.1.18. The device has a Aluminium/ Nanocomposite / Indium tin oxide sandwiched structure, which has been developed with all the steps done using plasma processes. The working principle of the



(A)

(B)

Figure 1.1.18. (A) *Schematic diagram of BHJ solar cell,* **(B)** *Photograph of organic photovoltaic device developed at IASST.*

Director, scientists, research scholars and collaborator Prof. D.S. Patil, BARC testing the first organic solar cell developed by plasma based process at IASST

Fabrication has been done by taking the nanocomposite thin film as the active material and ITO and Aluminium films as two electrodes. The solar cell (TiO_2-Polyaniline) shows photovoltage of 0.23 V at 70 mWatt/cm^2 solar intensity, whereas TiO_2-Polythiophene solar cell shows a voltage of 0.40 V at 70 mWatt/cm^2 solar intensity. Variation of photovoltage of TiO_2-Polyaniline with incident solar radiation is shown in Fig. 1.1.19. Further research work for improvement of the efficiency of the cell is in progress.

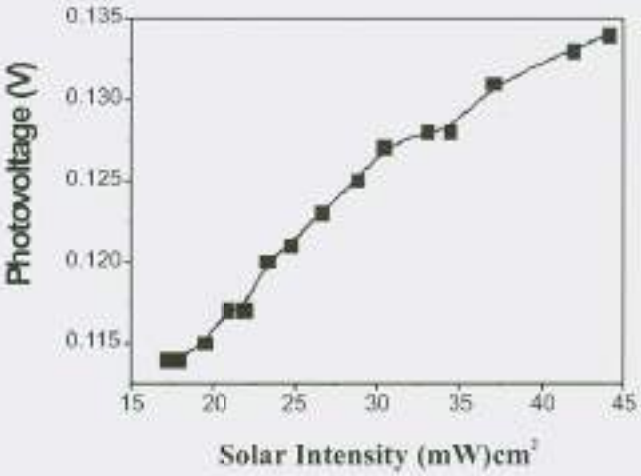


Figure 1.1.19. *Plot of Photovoltage vs. solar radiation intensity for Polyaniline/TiO_2 solar cell.*

1.2 Polymer Section

Polymer Science Section was developed in the year 2002 by the initiative of Professor N.N. Dass the then Director of IASST. The unit is gradually growing up under Material Sciences Division and efforts are being made to develop high value polymers like viscosity index improver, polymer ionics, adhesives, polymer foams and liquid crystalline polymers. Plasma assisted polymerization has been developed in the section to polymerize acryl amide in nano fine state. In the recent years liquid crystalline polymers have been used to develop sensors to sense temperature and different types of gases. Other works carried out

include investigating optical properties of some nanomaterials like metal nanoparticles anchored to bifunctionally capped quantum dots.

1.2.1 Development of liquid crystalline polymers suitable for fabrication of thermistor device.

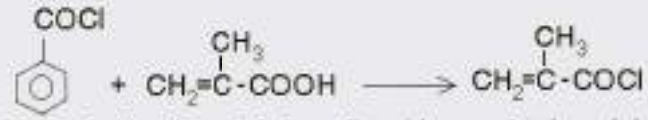
In the present work polysulfones and co-polysulfone with cholesteric units has been chosen for the synthesis of liquid crystalline polymer. Since the polysulfones and co-polysulfones are highly sensitive to temperature therefore these materials are suitable for fabrication of thermistor type safety devices.

The best material synthesized so far are poly-sulfone of cholesteryl methacrylate (PCHMAS) and co-poly-sulfone of cholesteryl methacrylate with n-hexene (PCHMASH) considering their molecular weights and thermal behaviours.

The materials were synthesized using the following steps:

i) Preparation of acid chloride of methacrylic acid:

Acid chlorides were prepared using appropriate quantity of the acid and benzoyl chlorides refluxing in a reflux condenser at their boiling point.



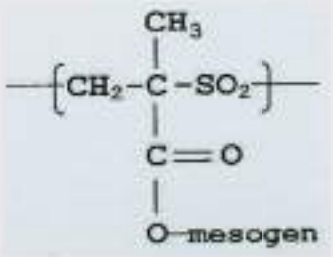
Benzoyl chloride — Methacrylic acid — Methacrylol chloride

ii) Preparation of ester of the acid using the acid chloride:

Ester of the acid was formed by reacting acid chloride with cholesterol under suitable condition.

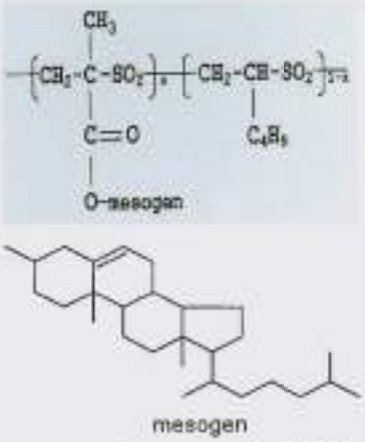
iii) Polysulfonation of mesogenic (cholesteryl) esters:

The mesogenic ester was dissolved in chloroform and transferred into a vacuum tube. A mixture of t-butylhydroperoxide with methanol was then added to it. The vacuum tube was kept in side a 1.5lire liq. N_2 canister at below 0°C and the tube is evacuated and SO_2 gas was passed in to the reaction tube. After completion of the reaction it was poured in acidified methanol. The product was washed several times with acetone or ethyl methyl ketone



iv) Copolysulfonation of mesogenic esters:

The mixture of cholesteryl ester with n-hexene (1:1 mole ratio) was dissolved in chloroform and transferred into the vacuum tube and the polymerization was done as before. The terpolymer was isolated and then recrystalized from hot methanol containing traces of chloroform. Finally residue was washed several times with acetone or ethyl methyl ketone.



mesogen

Under hot-stage microscope the following results were obtained:

CHMA: Melting starts at around 85°C and completely melts at 115°C.

PCHMAS: Melting starts at around 87°C and completely melts at around 152°C.

PCHMASH: Melting starts at around 160°C and completely melts at around 195°C.

The materials were characterized by analytical and spectral methods. Liquid Crystalline behavior was monitored under hot-stage microscope and tallied with DSC and TGA.

Sulfur, both in PCHMAS and PCHMASH were estimated by SEM-(EDX) method. The percentage of sulfur in PCHMAS is 2.13% and that of PCHMASH is 4.56%.

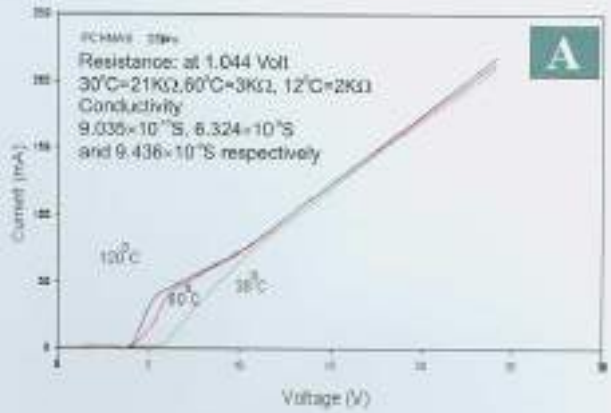
The device is finally fabricated putting the compound PCHMAS and PCHMASH between two copper plates (Fig. 1.2.1). The compound PCHMASH is more stable and easy to handle for its higher melting point and more polymeric character in nature.

Figure 1.2.1. *Thermistor devices of PCHMAS and PCHMASH*

Study of I-V Characterization by two probes method:

I-V characterization result by two probes method for both PCHMAS and PCHMASH showed that the breaking voltage is very close to 5volt where a sudden rise of about 40mA current is observed when voltage is raised further (Fig. 1.2.2). Breaking voltage decreases with the rise of temperature. Before and after breaking voltage the materials show ohmic behaviour.

The device was illustrated using a circuit build around with an operational amplifier (Fig. 1.2.3). The device gives a stable resistance and its resistance decreases with the rise of temperature (Fig. 1.2.4).



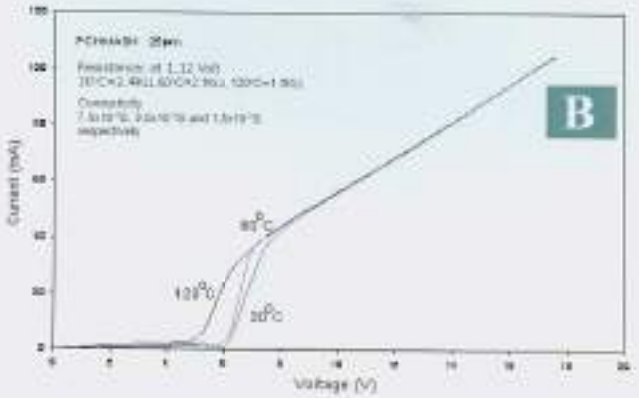


Figure 1.2.2. (A) *I-V characteristics of PCHMAS* **(B)** *I-V characteristics of PCHMASH.*

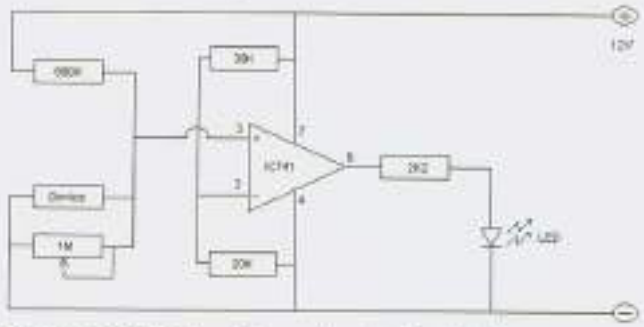


Figure 1.2.3. *Circuit used to test the device.*

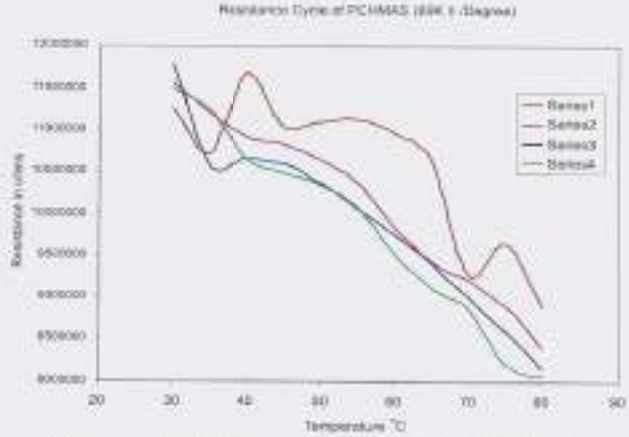


Figure 1.2.4. (A) *Resistance cycle of PCHMAS*

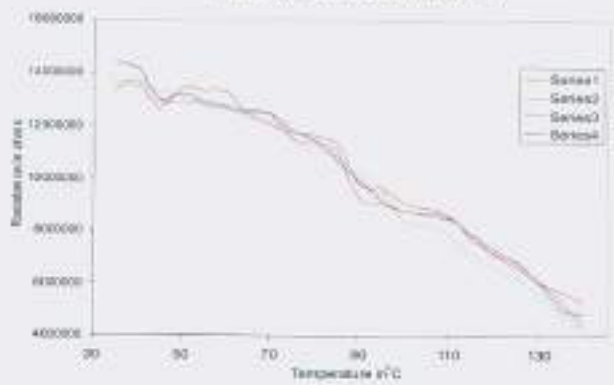


Figure 1.2.4 (B) *Resistance cycle of PCHMASH.*

1.2.2 Optical properties of metal nanoparticles anchored to bifunctionally capped CdS nanocrystals

Cadmium sulfide (CdS) nanocrystals continue to generate scientific and technological interest, owing to their valuable optical, electronic, and chemical properties. CdS nanocrystals have proven to be an ideal system for exploring large number of quantum phenomena at the nanoscale and investigating property-size relationships. Particularly, the blueshift in the energy gap, which is observed as the dimensions of nanoparticles approach the Bohr radius of an exciton that can be applied in optoelectronic applications. CdS, an important II-VI semiconductor with bandgap energy of ~ 2.42eV at room temperature and is one of the most important electronic and optoelectronic semiconductor nanomaterials. Its bandgap energy can be further widened into the UV region by reducing the particle size into the nano regime. To achieve superior optoelectronic properties, various organic molecules are successfully being used to cap CdS nanoparticles. Aqueous nanocrystal synthesis relies on functional capping agents to control nanocrystal form and function. However, attaining desired optical properties is difficult in practice because of the surface defects that quench the luminescence due to transitions between nonradiative recombination centers. Thus organic or inorganic capping agents are hence needed to stabilize and passivate the nanoparticle surfaces. The bare CdS NPs is also susceptible to aggregation. The CdS NPs will remain stable with respect to aggregation only if there exists a repulsive force of sufficient strength to counteract the van der Waals attraction. Binding of certain amphiphilic molecules to the surface of NPs provides a steric barrier to aggregation. The optical and electrical properties of semiconductor nanoparticles are found to be very sensitive to surface modifications. The capping or passivation of the semiconductor's surface by organic or inorganic molecule produces the particles with improved physicochemical properties. It is reported that thiols are the best capping ligands for II-VI class of nanoparticles.

In this work we use sulfur containing bifunctional capping agent. The advantage of having bifunctional (with two different functional group) capping agents like 1-6 hexanedithiol, Mercapoethanol, Thioglycerol etc is that one functionality can stabilize the nanocrystals and other functionality may be further modified and used for specific purpose. In this regard the modification at the other end of the capping agent can be anchoring of nanoparticles (gold, silver) etc which will lead metal enhance fluorescence of the QDs moieties.

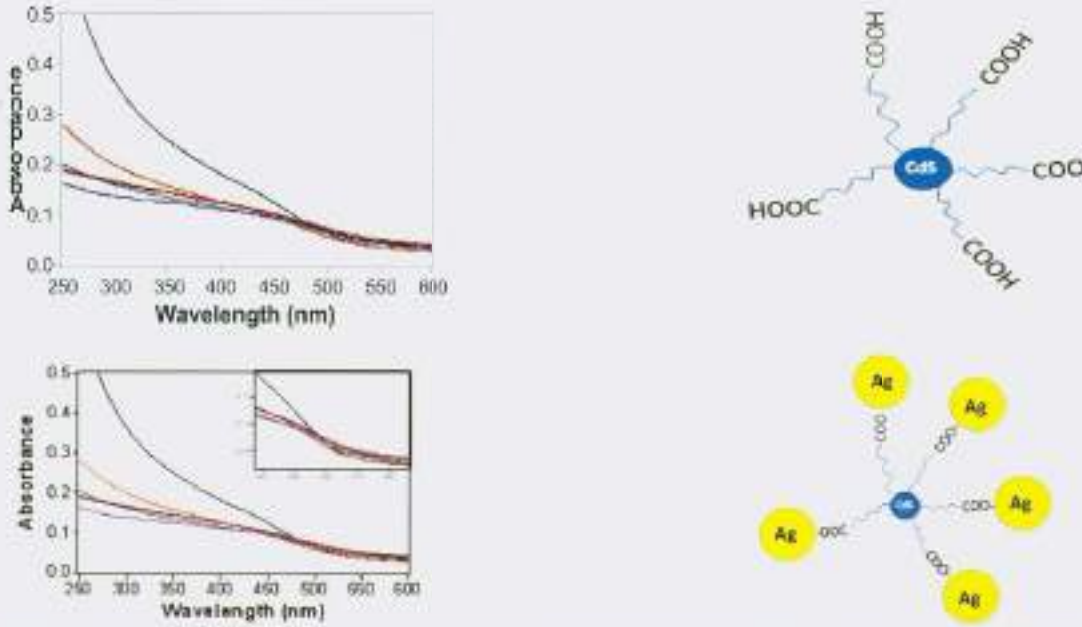


Figure 1.2.5. (A) *UV-vis spectrum of CdS nanocrystals and its evolution with the introduction of different amount of mercaptoundecanoic acid.* **(B)** *UV-vis spectrum of mercaptoundecanoic acid stabilized CdS nanocrystals and its evolution with the introduction of different amount of Ag nanoparticles.*

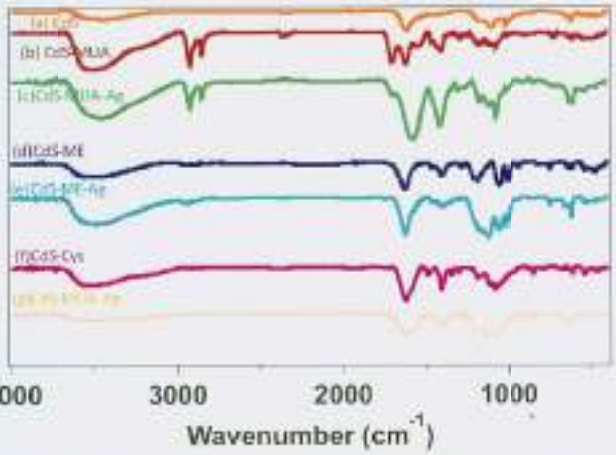


Figure 1.2.7. *FTIR spectra of* (a) *CdS* (b) *MUA capped CdS* (c) *Ag nanoparticles anchored MUA capped CdS* (d) *ME capped CdS* (e) *Ag nanoparticles anchored ME capped CdS* (f) *Cys capped CdS* (g) *Ag nanoparticles anchored Cys capped CdS.*

While the uncapped CdS shows the characteristics peak at 618, 536 and 463 cm^{-1} assigned to Cd-S_{str}, S-S co-ordinated to Cd and S-S bonding in CdS respectively. After capping with MUA, the FTIR spectrum shows the emergence of new peaks, most noticeable being the 2919 cm^{-1} and 2850 cm^{-1} peak of H-C-H_{str} band of MUA chain. Other peaks include 1405 cm^{-1} peak due to CH_2-S and C-S peak at 1295 cm^{-1}. The absence of S-H_{str} band at 2555 cm^{-1} characteristics of thiol confirms the successful capping of MUA to CdS surface. The COOH peak at 1700 cm^{-1} is also observed.

After anchoring with Ag nanoparticles, the MUA capped CdS nanocrystals, the COOH peak at 1700 cm^{-1} diminishes and two broad and intense peaks at 1410 cm^{-1} and 1564 cm^{-1} possibly of symmetric and asymmetric stretching vibrations of COO^- are observed. Similarly the ME capped CdS nanocrystals shows peaks in spectral range 1470-1300 cm^{-1} due to CH_2-O_{str} and 400-600cm^{-1} assign to S-S bond. Two small peaks at 934 and 814 cm^{-1} assigned to anti-symmetric and symmetric stretching of C-S bond is observed. Here too the absence of S-H_{str} band at 2555 cm^{-1} characteristics of S-H group confirms the successful capping of ME to CdS surface. After anchoring of Ag nanoparticles to the ME capped CdS nanocrystals, noticeable shift of O-H_{str} peak is observed. Similar spectrum was observed for L-Cysteine capped CdS nanocrystals with characteristics peaks of cysteine and absence of S-H peak confirming the capping of CdS nanocrystals with Cys.

Atomic Force Microscope Studies

Atomic force microscope images were taken of the MUA capped CdS nanocrystals and Ag NPs anchored MUA capped CdS nanocrystals. The samples were prepared by placing the respective solution on silicon wafer and imaged after drying. Figure 1.2.8 (A) shows representative AFM images of MUA capped CdS nanocrystals. The

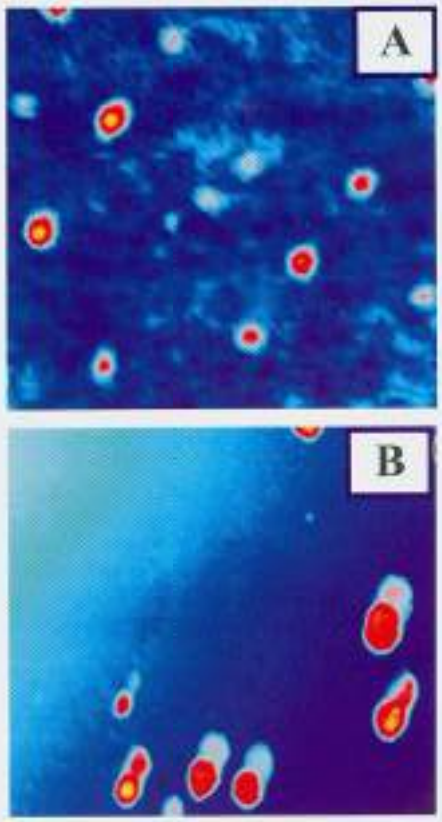


Figure 1.2.8. *AFM image showing Ag nanoparticles bounded to mercaptoundecanoic acid stabilized CdS nanocrystal.*

size of the MUA capped CdS nanocrystals were around 10-20 nm.

There is no noticeable change in size of the uncapped CdS (Image not shown) and MUA capped CdS. After adding of Ag nanoparticles to MUA capped CdS nanocrystal, the Ag NPs get anchored to MUA capped CdS nanocrystal. Figure 1.2.8 (B) clearly show the anchoring of Ag nanoparticles to MUA capped CdS NCs. The AFM image is the direct evidence of the anchoring of Ag NPs to MUA capped CdS NCs. Here it is interesting to note that instead of core shell structure we got nanostructure in which it appears that CdS nanocrystals are fused with Ag Nps.

2. Life Sciences Division

The Division consists of two major sections: Drug Discovery: Biochemistry/Medicinal plant and Scribiotech.

2.1. Drug Discovery: Biochemistry / Medicinal plant section

Despite the progresses in modern medicine, it has been reported that more than 70% of the Developing world's population still depends on complementary and alternative systems of medicine, otherwise known as traditional medicine. Plants produce a vast array of secondary metabolites as defense against environmental stress or other factors like pest attacks, wounds, and injuries. The complex secondary metabolites produced by plants have found various therapeutic uses in medicine from time immemorial. The early history of modern medicine contains descriptions of plant-derived phyto-chemicals, many of which are still in use.

The whole North-Eastern region of India is full of natural resources and many of them are yet to be explored scientifically. The scientists of this Division are engaged in isolation, identification and manipulation of active phyto-constituents present in some medicinal plants/ fruits of this region for the betterment of the health care system of the poor as well as other people.

2.1.1 Anti-dermatophytic Drugs from Natural sources

Dermatophytes are the most common causative agents of cutaneous mycosis and remain a major public health problem inspite of the availability of an increasing number of antifungal drugs. Dermatophytoses, considered as zoonosis, have created more public health concerns due to close contact between humans particularly children and animals such as dogs, cats, birds, and small rodents or pocket pets. The clinical symptoms may not pose a serious threat, but effective treatment is usually costly and time-consuming. Several antifungal agents including various azoles, tolnafate cream and allylamine derivatives were introduced in the treatment. However these antifungal agents are expensive and have varying degrees of toxicity. Hence, there is a need for new antifungal agents with broad spectrum activity which are cheaper and with no or less toxicity.

The incidence of dermatophytic infections has increased considerably during the past decade. The search for simple bioactive compounds derived from plants that can be used against fungi has been a research direction for ecologically safe products. Herbal medicines have been known to man for centuries. Some Indian medicinal plants have been used widely in treating a variety of skin diseases by the Sidha and Ayurvedic physicians.

Based on the ethnobotanical knowledge and local use of some plants against common skin diseases, an attempt has been made to assess the antidermatophytic properties of some medicinal plants readily available in Assam and the North East part of India. Plant extracts and essential oils of the collected plants were tested against some common infectious skin pathogens of the region. Among the plants *Piper betle* Linn., *Allamanda cathertica* Linn., *Cinnamomum porrectum (Roxb.) Kosterm, Trachyspermum ammi* (Linn) Sprague showed very fruitful results. The individual extracts of these plants and their (w/w) combination against five species of dermatophytes, *viz. Trichophyton mentagrophytes, Trichophyton rubrum, Trichophyton tonsurans, Microsporum gypseum* and *Microsporum fulvum* were tested which showed very strong Antidermatophytic potential of these plants. Agar cup diffusion technique was used to determine the inhibition zone diameter for different extracts, whereas the minimum inhibitory concentration of the extracts was determined using two fold serial dilution method (Fig. 2.1.1). The MIC values of the active extracts were found ranging between 0.312-1.25 mg/ml. For the *in-vivo* test 5% extract ointment of the individual extracts and their combination were prepared and was used effectively against induced superficial dermatomycoses in Guinea pigs with subsequent removal of infection in 35-50 days (Fig. 2.1.2). Chloroform extracts showed higher activity than methanol while water extract was found to be the least active of all tested extracts. The work is in progress.

In-Vitro Results

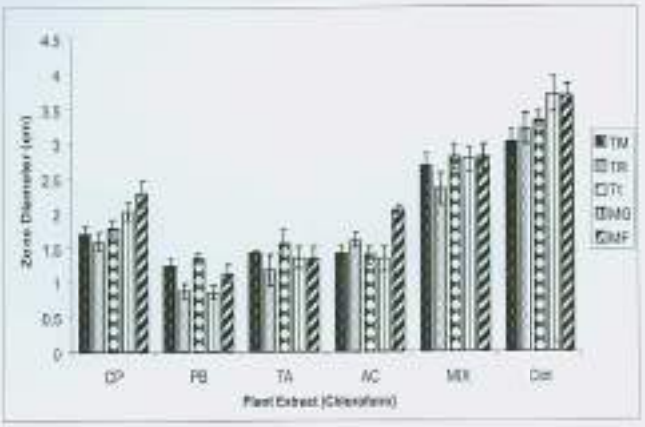


Figure 2.1.1. ***Graph of inhibition zone at 0.625 mg/ml (mm) mean±SE. n= 3.***

In-Vivo Results

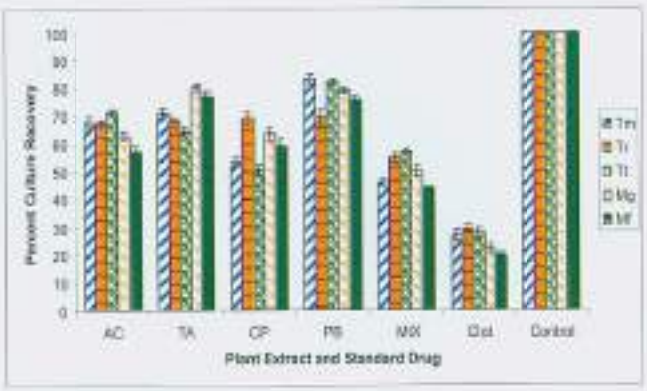


Figure 2.1.2. ***Graph of % Culture recovery after 20th day of infection.***

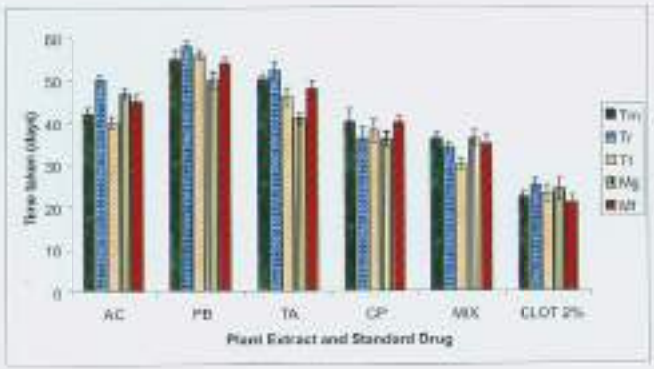


Figure 2.1.3. ***Graph showing healing time taken by different extracts at 5% conc.***

In-Vitro Photohraphs

Injection of sample for vaginal Mucus membrane test in female rabbit.

Prepared Extract ointment A & B and Herbal base C

Primary skin Irritation test in Rabbit

MIC Determination by two fold serial dilution method

2.1.1 Assessment of risk due to the intake of artificial colours

Colour is an extremely important aspect in the quality assessment of food and it is well known that the color level does strongly influence the

Figure 2.1.6.a (A-G) *Some representative food items collected from different places.*

perception of flavor and sweetness. Food colorants are therefore widely used as additives in the food processing industry, mainly to balance colour losses occurring during the production process but also to raise specific consumer expectations or to attract the attention of certain consumer groups, especially children. Colorants are usually divided into two groups, namely Natural and Synthetic food colorants: Natural colours like Chlorophyll, Caramel and Annatto; and Synthetic ones that are chemically synthesized and have high tinctorial strength (colouring capacity). Synthetic colours are being preferred by the vendors / manufacturers to Natural colours due to their low cost and high tinctorial strength. Synthetic colours are further classified as "food colours" and "non-food colours". The first are those that can be used in foods after thorough toxicological evaluation. Use of non-permitted colours can result in severe gastrointestinal side effects; allergy and can even damage some vital organs. There are many non-food colours that can be harmful. For example, Congo Red, Rhodamine B, Malachite Green, Orange G, Sudan III, Lead Chromate, Ultra Marine Blue, Metanil Yellow and other textile dyes are used in food preparations.

We have undertaken the present study to generate the baseline data and assess the health risk due to the intake of artificial colours through foodstuffs available in the North-Eastern region and the inspire people for using Natural food colors. The prime objective would be to extract compounds, which are stable to heat, lights and other physiological factors and can be used as an alternative to the hazardous synthetic food colors.

Already undertaken the following target

1. Sample of different coloured food & related samples collected from three states, Nagaland, Manipur and Assam.
2. Assessing the levels of these colours in the foodstuffs collected.
3. Analysis and estimation of different synthetic colours present in these artificially coloured foodstuffs.

Foodstuffs with added colours were collected from various outlets such as supermarkets, bakeries and sweetmeat stalls, wholesale markets, school zones, vendors and common markets of rural and hilly areas (Fig. 2.1.6a). The foods are analyzed for food colours using the wool-dye technique and column chromatography techniques (Fig 2.1.6b) following standard protocol. The quantitative analysis of the single colours in water solutions is done directly by measuring the absorbance values.

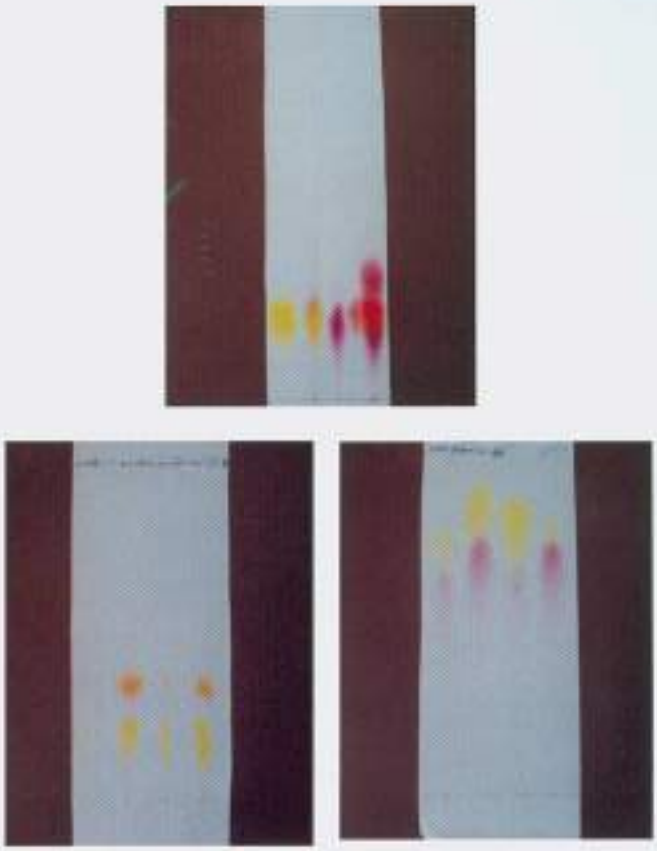


Fig 2.1.6b *Analysis of food colours by paper chromatography*

Blends of colours, are separated by paper chromatography and the separated colours are then eluted from paper into water solutions and their absorbance is measured against standard colours using a Spectrophotometer. The work is in progress.

2.1.3. Assessment of the Impact of anthropogenic activities on soil, water and certain medicinal plants in some polluted localities of Guwahati city

Anthropogenic activities, processes or materials are those that are derived from human activities, as opposed to those occurring in biophysical environments without human influence. The term is often used in the context of environmental externalities in the form of chemical or biological wastes that are produced as

byproducts of otherwise purposeful human activities. In the modern industrialized world, anthropogenic activities (man-made activities) are perhaps the only known cause of the alarming situation in respect of pollution.

The major anthropogenic pollutants that are found in soil, water and air are polycyclic aromatic hydrocarbons (PAH), heavy metals and pesticides etc. PAH, heavy metals etc are released into the environment through the incomplete combustion of organic materials like coal, oil, gas, tobacco and forest fires etc, whereas pesticides and other harmful chemicals escape into the environment through various agricultural activities etc. These compounds do not readily dissolve in water and also generally do not burn completely. As a result they are resistant to degradation and are a cause of concern to the environment. These compounds gain significance as chemical pollutants in the environment because they are reported to be genotoxic and may cause mutations and certain types of cancer. These compounds may get converted into carcinogens through metabolic activation in the organism. All these causes are directly linked to the human health including the occurrence of diseases like cancer, diabetes, heart, liver, lung and nerve ailments and some very uncommon diseases in this part of the world.

Sample collection: Based on the present study we collected samples from different parts of Guwahati city mainly near the large automobile servicing and repairing units, heavy traffic areas and low traffic areas and near oil depots within the municipal limits of guwahati city and from the motor highway areas in urban locations. Collected samples were soil, sediments and plants (Fig. 2.1.7). Following was the course of sample collection: (1) Bahini river course (2) National highway (3) A.T Road (4) Bharalu river course (5) Noonmati area (6) Zoo road.

Sample preparation: After collecting the samples, they were then dried at room temperature in shade, finely powdered, sieved with 200-300 mesh, mixed thoroughly and approximately 10-100 gm were used for extraction.

Extraction procedure: The prepared samples were subjected to extraction following the standard protocol as given below:

Heavy metal estimation: for the presence of different metals in the collected soil, plant and sediment samples was done according to the Wet digestion AOAC 2000.

Analytical methodology for PAHs: Determination of PAHs in soil and plant sample was done by sonication extraction followed by HPLC with flourimetric detection.

Students are seen collecting sample from the field for analysis:

(A) Collection from Highway sites

(B) Sample collected from Bahini river

(C) Near polluted Industrial sites

(D) Processing of collected samples

(E) Collected edible plants from polluted sites

Figure 2.1.7. (A-E) *Sample collection for assessment of the impact of anthropogenic activities.*

2.1.4. Development and Evaluation of Nanoparticulate drug delivery systems

Drug targeting is the delivery of drugs to a desired receptor or organ or any other specific part of the body, where the action of the drug is exclusively required. Drug delivery formulation are patent protected formulation technologies that modify drug release profile, absorption, distribution, and elimination, for the benefit of improving product efficacy and safety, as well as patient convenience and compliance. Paul Ehrlich proposed drug delivery to be a 'magic bullet' where a drug-carrier complex/ conjugate delivers drug exclusively to preselected target cells in specified manner. The main objective of the scientific labour through the whole world for developing drug delivery systems is to achieve desired pharmacological response only at a preselected site without undesirable interactions at other sites and thereby reducing the side effects.

Nanoparticles are used as adjuvant in vaccines or drug carriers in which the active principle drug (or) biologically active material is dissolved, encapsulated or entrapped and to which the active principle is adsorbed or attached. The constituents of nanoparticles for biomedical application need to be physiologically compatible or biocompatible and they need to be biodegradable to physiologically harmless components or to have the ability to be excreted via kidney or bile. Nanoparticles are carrier of drugs as well as for peptides and proteins, enzymes, vaccines, or antigens. Nanosphere or nanoparticles are homogeneous matrix systems in which the drug is dispersed throughout the particles, whereas nanocapsules are vesicular systems in which the drug is confined to a cavity surrounded by a polymeric membrane. Nanocarriers for pharmaceutical use can be of polymeric nature or consist of lipophilic components plus surfactants, i.e., liposomes, niosomes, and solid-lipid nanoparticles. Various proteins and polysaccharides are used for the preparation nanoparticles, for example gelatins, albumins, lectins, legumins, vicilin etc. are proteins and alginate, dextran, chitosan, agarose, pullulan etc. are polysaccharides. Some synthetic polymers including pol(€-caprolactone), poly(lactic acid), poly(lactide-co-glycolide), polystyrene etc. are used in the preparation of nanoparticles.

This study is an attempt to identify certain potential therapeutic agents used in the treatment of some diseases through their tagging with biologically active nanomaterials and ensure targeted and efficient delivery. The study involves several potential drugs established as potent therapeutic agents and their targeted drug delivery with greater efficacy.

Initial stage of this work has been completed like literature survey and collected raw materials from Suwalkuchi (Fig. 2.1.8).

The main objectives of this study are

- Selection of potential drugs for the studies
- Formulation of suitable nanoparticulate drug delivery systems using biodegradable biomaterials/biologically active polymers

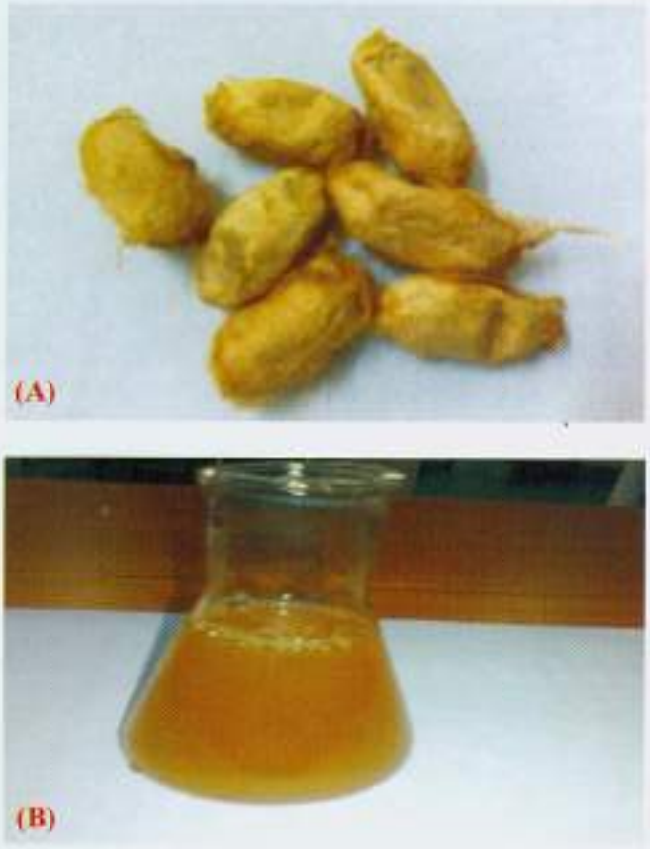


Figure 2.1.8. *Photograph of (A) Silk Cocoon and (B) Solution after extraction*

- In vitro evaluation of the nano-drug formulation size, shape morphology, loading efficiency, targeting efficiency, drug release pattern, stability etc.
- In vivo studies- drug targeting efficiency in suitable, in suitable animal model, pharmacodynamic studies, toxicological studies etc.

Extraction of silk Sericin protein

❖ Silk cocoons were collected from Sualkuchi

❖ Known amount of silk cocoons were cut into small pieces

❖ Cut pieces are boiled with water

❖ Water soluble proteins extracted including Sericin in water

❖ Extracted protein purified

Protein Estimation

❖ Protein estimation is done by 2 methods Lowry's method and Bradford's method following the established protocol.

2.1.5. Antioxidant and hypolipidemic activity of a di-herbal formulation of Northeast India

The herbal formulation of *Clerodendron colebrookianum* (CC) and *Allium sativum* (AS) is widely used as a home remedy in the Northeastern states of India. CC is one of the important medicinal plants available in this region and is widely used as a home remedy for hypertension by the tribal and non tribal people of this region mainly in NorthCachar hills of Assam, Tirap district of Arunachal Pradesh and the Lushai hills of Mizoram. Some people use the tender leaves; boil in water and serve as soup. In some cases, a decoction of tender leaves or twigs with a few pieces of garlic and taken with rice (Nath *et. al* 1991). A scientific study is being carried out in our lab as no study is yet reported on it.

Preparation of extract of di-herbal formulation

Extracts of *Allium sativum* (AS) and *Clerodendron colebrookianum* (CC) were prepared in various ratios of 2:1, 4:1, 8:1 and 10:1.The extract of ratio 2:1 was prepared by weighing 2g of fresh CC and 1g of Garlic cloves. They were ground together into a fine paste and 50 ml of distilled water was added to it and kept on a hot plate magnetic stirrer for 60 minutes at 30°C.The solution thus obtained was filtered with a muslin cloth followed by filtration through a Whatman filter paper. The extract thus obtained was stored in 4°C for later use. Similarly extracts of ratio 4:1, 8:1 and 10:1 were prepared by taking 4g of CC and 1g of Garlic, 8g of CC and 1g of Garlic, 10g of CC and 1g of Garlic respectively. They were processed as above to obtain clear extracts and stored at 4°C for later use.

In vitro experiment

DPPH radical scavenging activity of fresh extract of the formulation

The antioxidant activity was measured by 1,1-Diphenyl-2-Picrylhydrazyl (DPPH) assay described by Brand-Williams *et. al.*(1995) and the results were found very encouraging (Fig. 2.1.9).

Determination of *in vitro* lipid peroxidation

Invitro lipid peroxidation of various concentrations of the herbal formulation viz 1:10, 1:50, 1:100 and 1:200 was determined by the

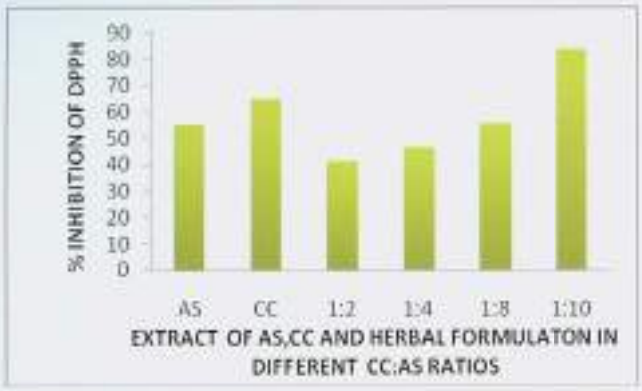


Figure 2.1.9. *DPPH radical scavenging activity of the extract of CC, AS and di- herbal formulation of Allium sativum (AS) and Clerodendron colebrookianum (CC) in different ratios (2:1,4:1,8:1,10:1).*

method of John and Steven (1984) and measurements were done spectrophotometrically at 532 nm (Fig. 2.1.10)

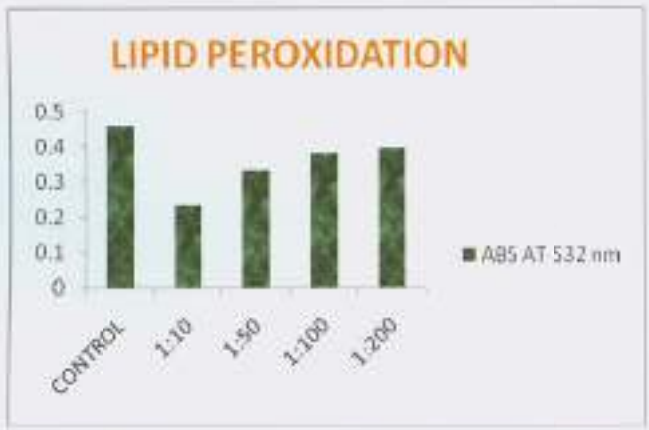


Figure 2.1.10. *Effect of di-herbal formulation aqueous extract in 8:1 (CC: AS) ratio on lipid peroxidation of rat liver homogenate.*

Determination of total reducing power of the extract of di-herbal formulation

The antioxidant activity of extract was evaluated in terms of reducing power using the method of Oyaizu (1986). The intensity of colour developed was measured at 700nm against a blank. Increased absorbance is indicative of increased reducing power (Fig. 2.1.11).

Phytochemical investigation

Estimation of total polyphenolic, tannin and flavonoid content

The amount of total polyphenolic content in the extract was determined with the Folin-Ciocalteu reagent, using the method described by Hagermann et. al., (2000). The amount of total

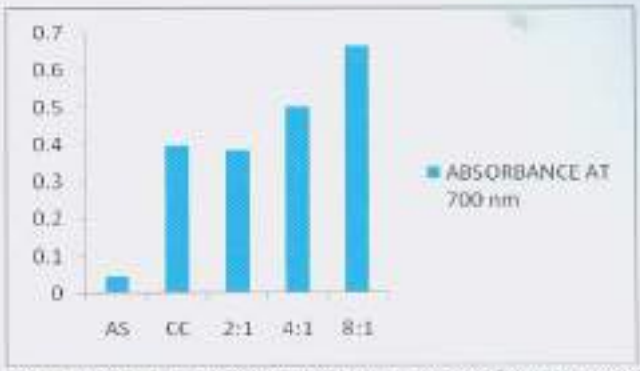


Figure 2.1.11. *Total reducing power of extracts of Allium sativum (AS), Clerodendron colebrookianum (CC) and the di- herbal formulation in different ratios of CC:AS (2:1,4:1,8:1).*

polyphenol was calculated as catechin equivalent from the calibration curve of catechin g^{-1} of fresh plant material (Fig. 2.1.12).

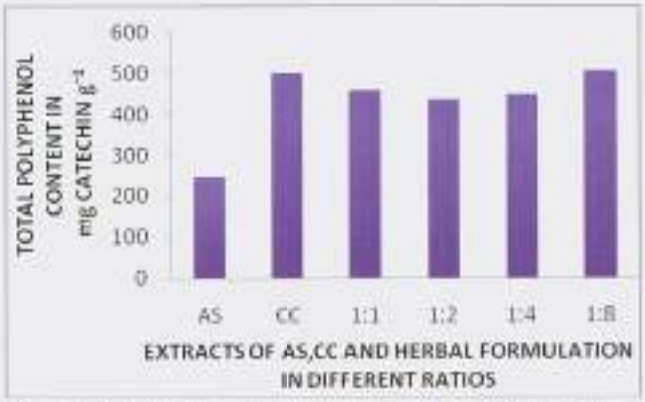


Figure 2.1.12. *Total polyphenol content of extract of Allium sativum (AS), Clerodendron colebrookianum (CC) and the di- herbal formulation in different ratios CC:AS (1:1,2:1,4:1,8:1).*

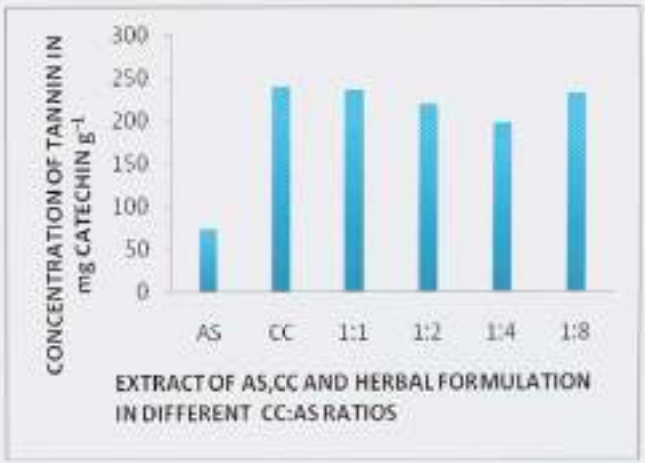


Figure 2.1.13. *Concentration of tannin in extract of Alium sativum (AS), Clerodendron colebrookianum (CC) and the di- herbal formulation in different ratios CC:AS (1:1,2:1,4:1,8:1).*

Total tannin was determined by Folin-Ciocalteu procedure after the removal of tannins by absorption with 100 mg PVPP (Liao and Shi, 2005) and the tannin amount was expressed as mg Catechin g^{-1} of fresh plant material (Fig. 2.1.13).

The flavonoid content was determined by Jay *et. al.*, (1975) method. The flavonoid content was expressed as mg Quercetin g^{-1} of fresh plant material. All measurements were done in triplicate (Fig. 2.1.14).

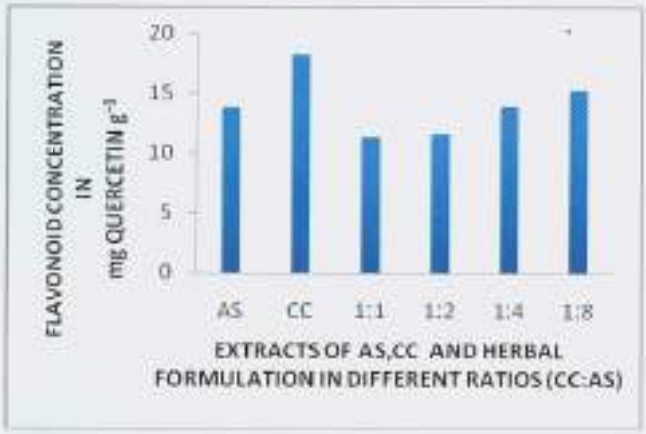


Figure 2.1.14. *Flavonoid content of extracts of Allium sativum (AS), Clerodendron colebrookianum (CC) and the di- herbal formulation in different ratios CC:AS (1:1,2:1,4:1,8:1).*

In vivo experiment

Overnight fasted rats were divided into four groups of five rats each.The first group served as control and the rats received only saline. The second group, the hyperlipidemic group (HG), was treated with an intraperitoneal injection of Triton WR-1339 (Tyloxapol) at a dose of 200 mg/kg in saline. In the third group (HG + CG), the hyperlipidemic rats were treated with the di-herbal formulation of 8:1 ratio at a dose of 0.5 g/100g of body weight following the intraperitoneal injection. In the fourth group the hyperlipidemic rats were treated with Fenofibrate (HG + FF). Triton was followed by intragastric administration of Fenofibrate. At 24 hrs after treatment, animals from each group were anasthetised with diethyl ether and blood samples was taken from tail vein using a heparinized capillary. The blood samples were immediately collected, centrifuged and serum was separated to estimate the lipid profile viz total cholesterol, triglycerides, LDLc, HDLc and VLDLc and results are shown in Fig. 2.1.15 and Fig. 2.1.16.

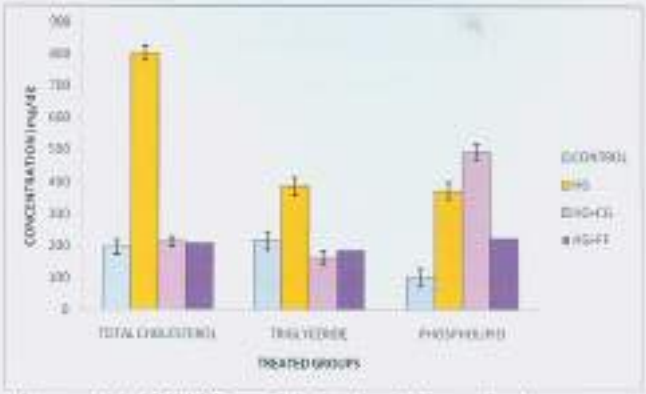


Figure 2.1.15. *Effect of di-herbal Formulation extract and Fenofibrate on total cholesterol, triglyceride and phospholipid after hyperlipidemia induced by Triton in rats.*

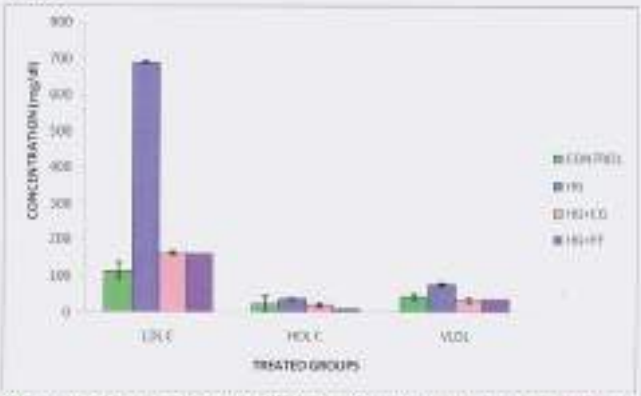


Figure 2.1.16. *Effect of di-herbal Formulation extract and Fenofibrate on LDLc, HDLc, and VLDLc after hyperlipidemia induced by Triton WR 1339 in rats.*

The results of the present study clearly indicate that extract of the di-herbal formulation has powerful antioxidant activity in various antioxidant systems *invitro* and *invivo*. The various antioxidant mechanisms of extracts in different CC: AS ratios maybe attributed to its strong lipid per-oxidation inhibitor, hydrogen donating ability and effectiveness as scavengers of DPPH free radicals. The total polyphenolic content estimation of the formulation confirmed the presence of high level of polyphenols in the extract which may be responsible for the potent antioxidant activity of the extract of the Northeastern di herbal formulation. Tannin and flavonoid contents were also noticeable. The reducing capacity of the compound may serve as a significant indicator of its potential antioxidant activity and in this study extract of the di herbal formulation showed potent reducing capabilities. *Invivo* results obtained indicate the hypolipidemic activity of the di herbal formulation. The studies are of great significance as the demand for herbal medicine is increasing constantly.

2.2. Seri Biotechnology

The Seri biotechnology unit under Life Sciences Division has been engaged in the basic as well as applied research on various aspects of silkworm and silk of NE Region for development of production and productivity.

2.2.1 Studies on muga silkworm

Grainage technology

Synchronisation of Moth Emergence using Photoperiodic Effect

Male and female cocoons of *Antheraea assamensis* Helfer were separated at the 3rd day of fifth instar larvae by observing the markings on 8th and 9th abdominal segments. After mountage they were subjected to different duration of light and dark phases (Figure 2.1.1 and 2.2.2). Female cocoons were divided into two lots of 25 each, namely A and B and subjected to light and dark (L: D) condition of 16:8 and 20:4 respectively. Similarly, male cocoons were divided into two lots C and D containing 25 cocoons each and exposed to 8:16 and 4:20 light and dark condition. Intensity of light used was 100 lux, measured by a Lux meter and temperature and relative humidity were maintained at 25- 27°C and 70- 80% respectively.

Figure 2.2.1. *Set- up for photoperiodic treatment*

Moth emergence took place after 12 days of treatment; the first one to emerge was the group B (female) which was exposed to maximum duration of light (20 hrs) followed by A,C and D. Usually the male moth emerges first but here the female moths emerged one day prior to the male moths.

The duration of light in the females were kept longer because it emerges late and was kept shorter in case of males because it emerges earlier. In the four photoperiodical resumes (A, B, C & D) we found that the A (16:8) for female and C (8:16) for male is suitable for synchronized emergence as they emerged on the same day. Thus we achieved a ratio of moth pairing of 1:2.5 whereas the normal ratio is 1:4 without photoperiodic effect. Significance was also there in fecundity and hatching percentage as it was more in case of moth emerging and pairing on the same day (Table 2.2.1).

Figure 2.2.2 *Cocoons being treated*

Morphometrics of colour morphs

Geometric morphometric methods provide powerful tools to describe and analyse biological form (Bookstein, 1996). The geometric morphometry represents an important new perspective to study the species variation as well as its covariation among populations (Rohlf,

Day	No. of males	No. of females	No. of pairing	Fecundity	Hatching %
I	10	8	7	239	86.7
II	10	13	9	242	85.3

Table 2.2.1. *Fecundity and hatching % of moths emerged on same day.*

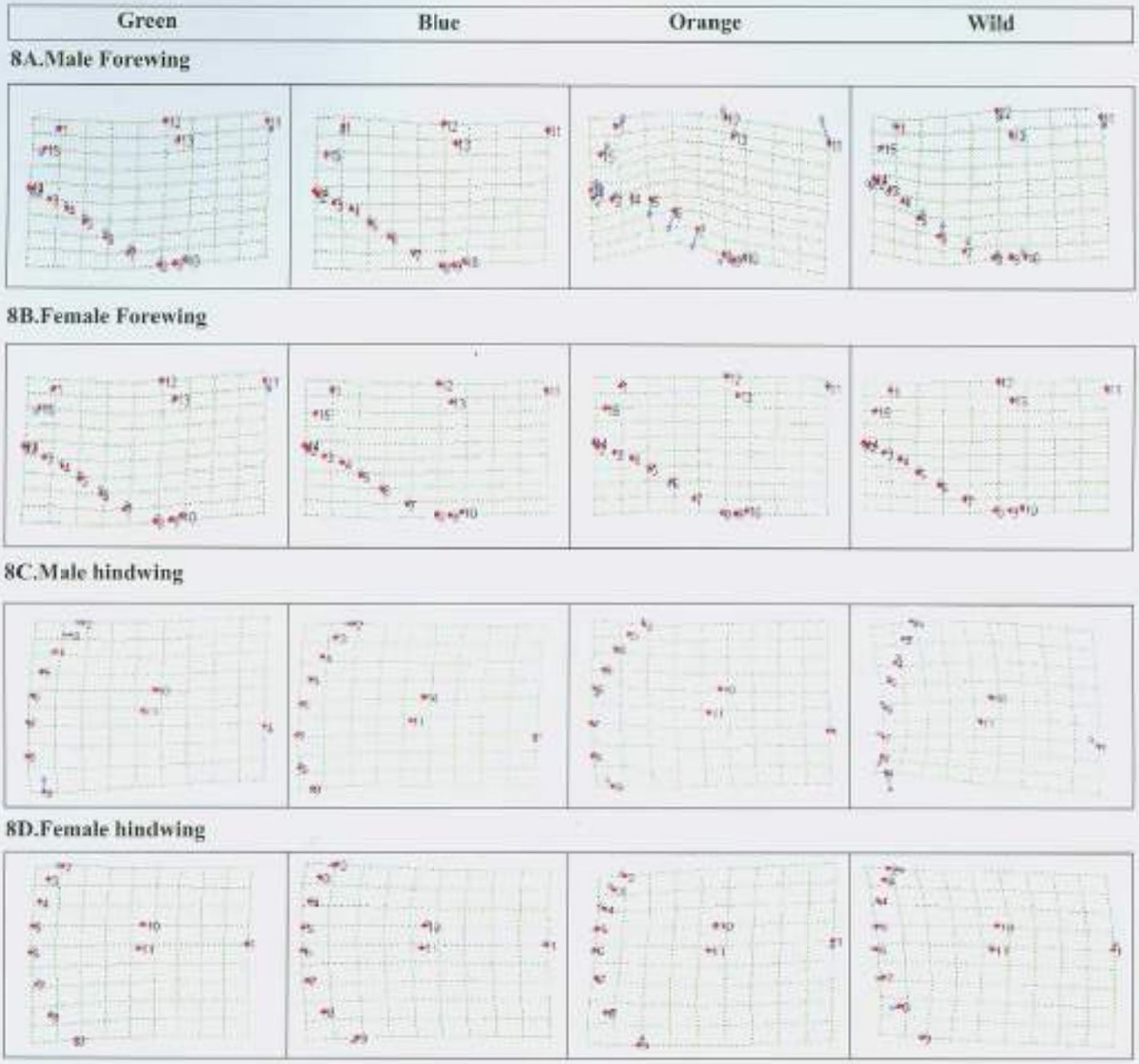


Figure 2.2.3. *Thin plate spline transformation grid of wing venation. 8A -Male Forewing, 8B-Female forewing, 8C-Male hindwing, 8D-Female hindwing. The grids show the thin plate spline transformation from the starting from (†) to the estimated configuration (o). The estimated shape at the root of the tree is used as the starting form.*

2002). Applications of traditional distance measurements are also used for size explorations; but it provides limited information about the shapes. Conversely, geometric morphometric methods inform shape variation mostly in a quantitative way. This is important, because typically taxonomic characters concern variation in shape rather than size (Mutanan, 2005).

Antheraea assamensis Helfer is a sericigenous insect with distinct coloration, namely green, blue, orange and yellow in their larval stages and these are multivoltine in culture. However, wild morphs with dipause are found in dense forests. In thid study, the wing venation and its variation in *Antheraea assamensis* were analysed using traditional as well as landmark based morphometric methods. The samples were analysed using geometric morphometric methods and other conventional statistical methods (Fig. 2.2.3). Results show significant differences in some of the veins among the intraspecies of *Antheraea assamensis*. The result suggests that both visual coparision as well as a quantitative approach in *Antheraea assamensis* may lead to unsound taxonomic conclusions at intraspecies level.

Apolipophorin III

Pseudomonas aeruginosa strain AC-3 isolated from diseased *Antheraea assamensis* (Muga silkworm) was found to be one of the causal organisms of flacherie in the host. The level of apolipophorin III (apoLp-III) in hemocyte free haemolymph of P. aeruginosa infected larvae of *Antheraea assamensis* was studied. The partially characterized apoLp-III protein (MW- 18kDa) was found increased during 16-20 h after infection and then decreased significantly after prolonged infection time (30- 60 h). It was noticed that four intermediate forms with molecular mass of 15, 13, 12 and 9 kDa appeared subsequently. The total proteolytic activity of haemolymph increased progressively during infection time. The result of this study suggests that a significant part of total proteolytical activity in the haemolymph of infected *Antheraea assamensis* larvae can be attributed to proteases (MW-35kDa) produced by *Pseudomonas aeruginosa* during pathogenesis. We discuss the possibility that the protease of *P. aeruginosa* is responsible for apoLp-III degradation.

2.2.2. Studies on Eri silkworm *Philosamia ricini* Hutt

Study of the Intraspecific competition in *Philosamia ricini* Hutt

Intraspecific competition for food during larval period was studied using a population of *Philosamia ricini* Hutt (Lepidoptera: Saturnidae) commonly known as Eri Silkworm. Eri silkworm is an economically important indigenous species prevalent to North Eastern part of India and is famous for its fiber with thermal properties and delicacy for some tribal people of this region. Larvae were divided into seven groups namely O, A, B, C, D, E & F each containing 1, 5, 20, 40, 60, 80 and 100 larvae respectively. The larvae were reared in circular bamboo trays of 60cm diameter and fed three times a day, morning, evening and night with equal quantity of Castor (green variety) leaves *ad libitum* measuring in a kg balance. This study showed that the competition affected the growth of *Philosamia ricini* Hutt larvae, as the densities were more the growth was less and larval development periods were lengthened.(Fig. 2.2.4). The larval weight decreased and the size of the cocoons was also affected showing a positive correlation with the other parameters. The emerged moths were of small size in the denser lot than in the fewer ones. The emergence of the moths was delayed in the denser regime. As the density increased the fecundity decreased, the sparsely dense ones showed higher fecundity and early hatching. Fiber quality like tensile properties (Tenacity, Toughness) were studied and the larvae reared in small numbers showed high tensile properties (Fig. 2.2.5).

The results of this study suggests that *Philosamia ricini* Hutt competes intraspecifically for food during larval periods and it affects their growth, size, larval duration, pupation, fecundity and yield parameters. Owing to its economic importance the rearing of this insect should be done in such a way that food resources during the larval period are ample and each larva should be supplied with a leaf quantity of about 10.2 g and allowed an area of about 70 cm^2 (i. e 40 larvae/tray of 60 cm diameter).

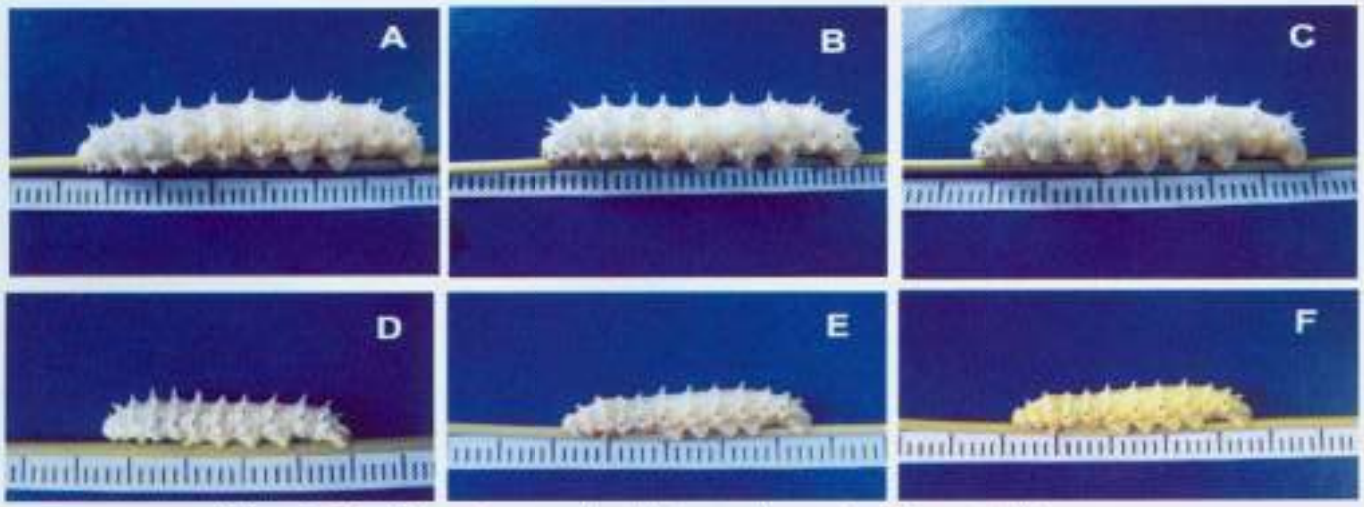


Figure 2.2.4. *Photomicrographs of 5th instar larvae in different feeding group*

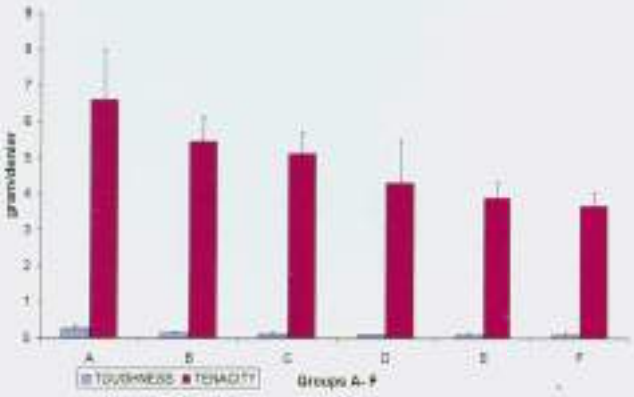


Figure 2.2.5. *Toughness (g/den) and tenacity (g/den) of Philosamia ricini Hutt in different groups. Data are average of 30 replicas and calculated the SD ± 30.*

2.2.3. Silk as Biomaterials

Fabrication and characterization of Fibroin films from liquid silk

Silk fibroin is a fibrous biopolymer produced by different silkworm species. Fibroin from domesticated silkworm *Bombyx mori* has been used extensively as biomaterials in biomedical applications from a long time. In this study, an effort has been made to prepare fibroin film from a non mulberry silk produced by *Antheraea assamensis* Helfer, an indigenous silkworm species exclusively confined to the North Eastern region of India. The unique golden brown coloured silk possess highest tensile strength (Tenacity- 3.476; Toughness- 0.9037) and UV absorption properties (more than 80%) among the four commercially exploited silks. Hence this silk might be a useful alternative biomaterial. Fibroin was purified from the liquid silk of silk gland of mature fifth instar larvae and from fibers of fresh cocoons. Thin film was fabricated using standard methods (Kaplan *et.al*; 2010). The native fiber and the film were characterized using SEM, FT-IR, XRD, DSC and TGA. Two prominent peaks at 1643 cm^{-1} and 1542 cm^{-1} were documented by FT-IR analysis which may be assigned to and phase respectively. Crystalline structure was studied by XRD revealing the inter conversion of and forms in stress condition and also less crystallinity compared to *Bombyxn mori* fiber. Negligible differences were observed between native fibers and films during this study. Due to the ever increasing demand of biocompatible biomaterials, it is expected that this study will open a new avenue in application of this silk in the fields like biomedical, cosmetics etc.

2.2.4. Study on wild Silkmoth

North Eastern part of India is a treasure house of sericigenous insects. Apart from the most commonly cultured commercial varieties namely Muga, Tasar, Eri and Mulberry silkworms some other silkworms are also available in wild forms. Owing to their ecological implications and potentiality as resources for silk industry, this vast pool of genetic resources has to be studied systematically. Thus some scientific study has been initiated at this unit.

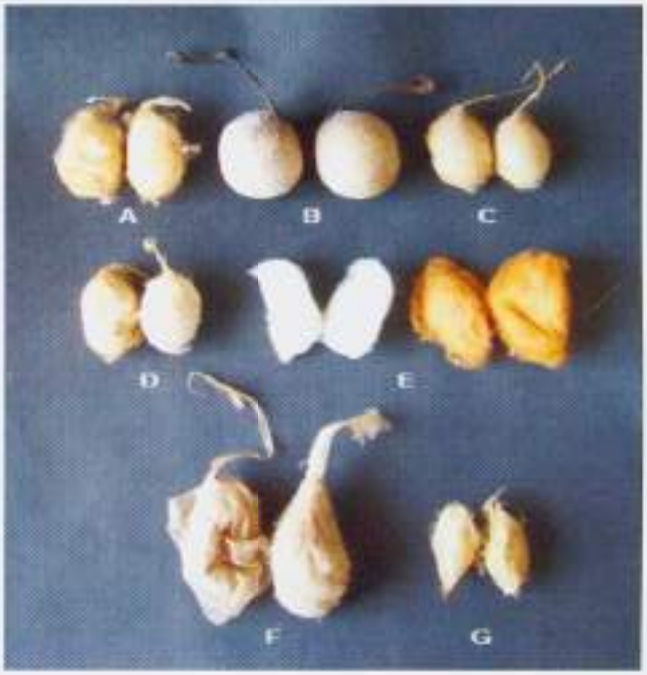


Figure 2.2.6. *Cocoons of non-mulberry silkworms- (A) Antheraea assamensis, (B) Antheraea mylitta, (C) Antheraea proylei, (D) Antheraea frithi, (E) Philosamia ricini, (F) Attacus atlas and (G) Cricula trifenestrata.*

Figure 2.2.7. *Oak Tasar Rearing on Arjun plant. Inset- a fifth instar larvae.*

2.2.5. Food plants garden

Figure 2.2.8. *Som Plant Garden.*

Medicinal plant garden

The medicinal plant garden of the institute having numbers of different species of medicinal plants of this region and it is maintained very nicely which serves not only our research purposes but also preserve some endangered species. The main objective of establishing this garden is to maintain a conservatory of not only the most common and important species of medicinal and aromatic plants which are being used in day-to-day primary health care but also those which are under various degrees of threats in India. All the plant species were authentically identified by expert taxonomists, labeled and in many cases their therapeutic values in curing different diseases are also highlighted. Few of them are *Citrus grandis, Citrus Morella, Clerodendron colebrookianum, Clerodendron viscosum, Terminalia chebula, Vinca rosea, Eugenia jambolana, Punica granatum, Ocimum sanctum, Cuinamomum tamala, Murrya koenigii, Pepar longum, Rauwalfia serpentina, Terminalia arjuna etc*

Part view of medicinal plant garden

Animal House Facility

For preclinical study of different type medicinal plants/ fruits of this region and also to study some effective molecules in in vivo condition an animal house has been constructed and it is maintained properly as per guideline of Purpose of Control and Supervision of Experiments on Animals (CPCSEA) and started to raise different species of laboratory animals viz Albino rats (Wistar), Albino mice (Swiss) Guinea pigs (Duncan Hartley) and Rabbits (New Zealand white) etc.

CPCSEA Nominee inspecting the caging of Animals in the Animal House

Grouping of animals for experiments

This Animal House is registered with CPCSEA, Government of India, Animal Welfare Division and waiting for Registration No. The meeting for the same was held on 28.01.11 in the Institute presided over by the Director, IASST

Institutional Animal Ethics Committee (IAEC) sitting in Feb. 2011

IAEC Members/experts after inspection of the Animal House of Institute after the meeting.

3.Resource Management and Environment Division

The Resource management and environment Division has been able to make important contribution in research towards solving various environmental problems specific to North East India since its inception. Some of the fields where significant contribution has been made are Bioremediation and phytoremediation of polluted Oil field soil, Studies related to chemical and enzymatic treatment of oil polluted soil, Bio-surfactants and their uses for recovery of hydrocarbons from refinery sludge and experimental field trial of phyto assisted bioremediation of hydrocarbon contaminated site allotted to us by Oil India Limited.

Another field where our contribution has been recognized is exploration and documentation of fauna in some remote areas spread over four states namely Assam, Arunachal Pradesh, Nagaland and Manipur. Completion of detailed eco-biological study of a number of species of frog and fish of conservational importance is a significant contribution from the research group.

There are three sections in this Division

1. Biodiversity section
2. Environmental biotechnology
3. Environmental chemistry

Research Scholars working in laboratory

Research Scholar working with laminar air flow

3.1 Biodiversity Section

The Eastern Himalaya "hotspot" is a part of wider Indo-Burma hotspot, which now includes all the eight states of the Northeast. In remote areas of Northeast India biodiversity is naturally protected in inaccessible and difficult hilly terrain. Documentation of existing fauna is yet to be completed in these areas. Exploratory surveys have been carried out in four states of North East India namely Arunachal Pradesh, Nagaland, Manipur and Assam. Main aim of the investigation was to verify existing species data with fresh collections, recording ecological data of habitat, eco-biological data of the species under investigation and to ascertain distributional and conservation status.

3.1.1 Study of Aquatic Biodiversity

A) Selected Watersheds of Arunachal Pradesh:

Survey was carried out in Diyung Thiep watershed and Sakchi Kho (river) watershed. Diyung Theip watershed is known as Tenga watershed and it lies approximately between 92°27' to 92°28' East longitudes and 27°12' to 27°14' North latitudes. Tenga river is the tributary of river Kameng which flows through Bhalukpong circle of the district and joins the river Brahmaputra in the plains. A greater part of the watershed falls within the mountain zone. Sakchi kho Watershed, Shergaon is located in the West Kameng district of Arunachal Pradesh. It lies approximately between 92°16' to 92°18' East longitudes and 27°07' to 27°08' North latitudes. Dublo kho river is a torrential river and its depth varies at different points ranging up to 1 meter. The river bed is stony with sandy bottom. The water of the river is clear. All the tributaries originating from the hills drain into this river.

The fauna so far recorded include aquatic insects, plankton and fish. Only torrential fauna that can adapt to the fast flowing condition of the water inhabit the hill streams present in the watersheds. From the watershed area 11 fish species belonging to 2 orders and 4 families and 9 genera has been recorded. From the study it was observed that the cyprinid (Order-Cypriniformes) *Schizothorax richardsonii* (Gray. 1832) is the dominant fish species in two river systems. High altitude aquatic insects belonging to 12 families and 7 orders were recorded during the survey. The aquatic insects belong to the following orders viz. Odonata, Hemiptera and Coleoptera

Figure 3.1.1 *A view of study site at Sakchi kho Watershed, Shergaon, Arunachal Pradesh*

3.1.2 Study of Aquatic biodiversity in Assam

i) Ecobiological study

Polypedates teraiensis (Dubois, 1987) is a very common frog in the entire terai region of the Himalayas. Detailed eco-biological study on this species has been completed. Normal developmental table has been prepared based on three years observation of this species during breeding season. Tadpoles belonging to all the developmental stages are described along with detailed morphological study of the adult. *Polypedates teraiensis* breed in rain-fed pools that

are sporadically filled by rain and then dry at different rates. The clutch size for *P. teraiensis* consists of about 100 eggs. The eggs of *P. teraiensis* measure 2.0-2.2 mm in diameter. The work includes study of morphology and development of *P. teraiensis*. It was found that *Polypedates teraiensis* completed its development and metamorphosis in 58 days and hatching took place after four days at an ambient temperature of 26-32°C. Tadpole morphology and SEM study of bucco-pharyngeal anatomy has been done.

ii) Study on Mites

Aquatic mites are important group of aquatic fauna which has remained under explored in NE India. Survey was taken up in different water bodies of Assam and has been included in the study on aquatic mites of India. A total of 21 species from Assam has been included.

3.2 Environmental Biotechnology Section

Environmental biotechnology is one of the fields of research which has to be undertaken actively for the benefit of the human being. It has played an important role in controlling environmental degradation. In environmental biotechnology section of the institute, some important researches have been carrying out to prevent environmental pollution from the time of its inception. At present, research on the following topics are in progress.

3.2.1 Phytoremediation of hydrocarbon contaminated soil in oil fields of upper Assam

Oil contaminated soil in and around exploration and spillage areas are still remaining a major environmental problem. The affect of oil spill has been frequently felt in the mining areas in the northeastern region of India. It causes noticeable damage to the environment and it is believed that this changes the chemical, physical and biological status of the soil in the vicinity. It is reported that the agricultural land near the oil exploration sites are often contaminated by hydrocarbons and land become unfit for cultivation. So, it is necessary to develop new and modern technology to restore the soil health due to contamination of hydrocarbon. Phytoremediation is a viable remediation method for petroleum-contaminated soil. The use of vegetation for remediation of contaminated sites is attractive and eco- friendly. So, in the present investigation, a study was carried out to investigate the phytoremediation potentiality of some selected native herbs, for hydrocarbon contaminated soil of oil exploration sites.

The soil sample collected from leakage site of GGS No. 4 of oil field of ONGC situated at Lakowa, Sibsagar district of Assam, India was characterized for physicochemical properties. The pH of the soil was acidic in nature (4.76), water holding capacity was very low (7.84%) and organic carbon content was high (9.7%). The highest amount of Total Petroleum Hydrocarbon (TPH) content was extracted by the solvent petroleum either (77000 ppm) from contaminated soil. The textural property of the soil was - sand 75.8%, silt 4.88% and clay 19.27%. TPH dissipation from contaminated soil after first harvest of the plants is presented in the Fig. 3.2.1. Maximum dissipation (57.89%) was found in the pots treated with *C. bravifolius* followed by *A. conyzoides*, *M. pudica* and *C. tora*. Minimum dissipation (13.3%) was found in control where no plants were introduced. The variation in dissipation percentage of TPH was statistically significant ($P < 0.05$) in different treatments. In all the treatments dissipation of TPH from the top layer of soil (0-5cm) was found higher than the bottom layer (5-10cm). Uptake of TPH is presented in the Fig. 3.2.2. Highest TPH uptake was found in the shoot of the plant *C. bravifolius* (41499.2 ppm) and root of the plant *M. pudica* (38028.6 ppm). Uptake of TPH was found lowest in the shoot of *M. pudica* (2808.8) and root of *C. tora* (8978.9 ppm). However, variation was not found statistically significant. Dissipation of Anthracene was also found highest (79%) in the soil where *C. bravifolius* was cultivated. Lowest was found in non-vegetated control soil (6.91%). Uptake of Antracene was found highest in *C. tora*, whereas it was found lowest in the plant *M. pudica*. No uptake of Anthracene was found in shoot of the *C. baravifolius*. The shoot and root biomass of the experimental plants is presented in the Fig. 3.2.3. The shoot biomass was found maximum in the plant *A. conyzoides*, on the other hand, the root biomass was found maximum in the plant *C. bravifolius*. It was revealed from the results that maximum TPH (77200 ppm) can be extracted from the soil by using petroleum ether whereas in case of acetone TPH extraction was

recorded minimum (58917 ppm). The bacterial population was found highest in the rhizosphere soil sample of *C. bravifolius* and in case of fungi highest was found in the rhizosphere soil sample

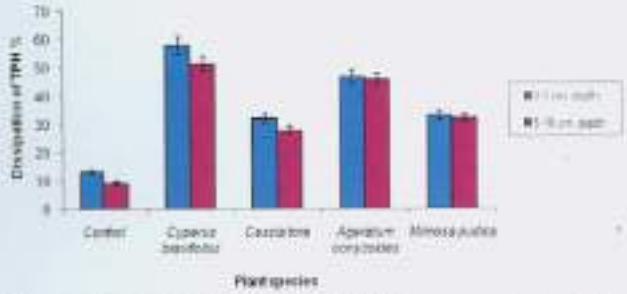


Figure 3.2.1 Dissipation of TPH from contaminated soil by different plant species

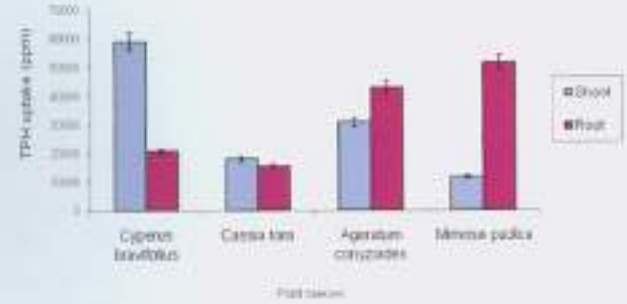


Figure 3.2.2 TPH uptake in the plant species grown in the contaminated soil after harvest

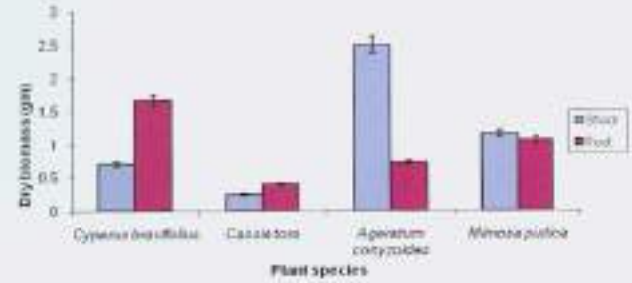


Figure 3.2.3 Dry biomass of the experimental plants after harvest

3.2.2 Bio-surfactants and their use for recovery of hydrocarbons from refinery sludge

Biosurfactants are diverse groups of surface-active molecules/ chemical compounds synthesized by microorganisms. These compounds are environmental friendly since they are biodegradable and have potential industrial and environmental applications. In this investigation, an attempt was made to recover hydrocarbons from refinery sludge by using bacterial synthesized biosurfactant.

In this investigation, 29 morphologically different bacterial colonies were isolated. Out of the 29 isolates, isolate no.29 could reduce surface tension to 31.4 mN/m which was the lowest of all the values and was selected for the study. On the basis of morphological and physiological pattern, the strain showed a high similarity to *Pseudomonas aeruginosa* (99%). When the partial 16S rDNA gene sequence was used for alignment in NCBI Genbank and RDP database, ten of the top ten matches were to *Pseudomonas aeruginosa* strains. Since the sequence similarities to *Pseudomonas aeruginosa* were uniformly 100%, the identity of strain RS29 was confirmed. These bacterial strains produced maximum biosurfactant at 37.5°C temperature with pH ranging from 7-8. Negative impact on biosurfactant production was noticed beyond 0.8% (w/v) of NaCl. The production of biosurfactant was growth associated as indicated by the growth and biosurfactant production kinetics. The surface tension was reduced to 27 mN/m. Evaluation of different nitrogen sources showed that ammonium nitrate was the best nitrogen source for bacterial growth whereas sodium and potassium nitrate could support maximum biosurfactant production. Change of pH during biosurfactant production in different nitrogen sources is also remarkable. The properties of biosurfactant extracted by chloroform-methanol were investigated and it was found that the biosurfactant was rhamnolipid type in nature as rhamnose assay was tested positive. The absorption bands observed in the IR spectra also revealed that the structure of the isolated biosurfactant was similar with other biosurfactants of rhamnolipid type. The extracted biosurfactant had good foaming and emulsifying activities. It was stable even after exposure to high temperatures (up to 121°C for 15 min) and it could withstand a wide range of pH and NaCl concentration.

The isolated *Pseudomonas aeruginosa* RS29 is a very potent biosurfactant producing bacterial strain. The quality of the biosurfactant produced by this strain is satisfactory from stability and activity point of view. The experiment of recovery

of hydrocarbons from refinery sludge by using the biosurfactant is going on.

3.2.3 Microbial biosurfactants as biocontrol agent

Biosurfactant has certain role in agriculture industry. Purified biosurfactants can be used as biocontrol agent to see whether they are effective against zoosporic plant pathogens. Potato late blight disease caused by the zoospore-producing pathogen *Phytophthora infestans* (Mont.) de Bary is one of the most destructive plant diseases world-wide and currently its management mainly relies on the frequent use of fungicides.

In the present investigation it is proposed to investigate the possibility of reducing potato late blight by biocontrol with the biosurfactant producing strains.

For conducting the experiment, a total of 36 bacterial strains have been isolated from the soil. The screening of potent biosurfactant producing bacterial strains from the 36 numbers of isolates is going on.

3.2.4 Evaluation of possible candidate species for phytoremediation of vanadium and Chromium

Due to mining, industrial and agricultural activity, soil receives a wide range of contaminants. Among them heavy metal is one. These contaminants may change the physico chemical properties of the soil. Such a change may also damage the soil health as well as soil ecosystem. These contaminants are considered hazardous substances when entered into the soil and transmit to the animal body including human being through food chain. Accumulation of these hazardous substances in the body of animals or men may cause serious diseases and even culminating to death. Thus it becomes indispensable to protect our precious soil resource from contamination of hazardous waste materials. To recover the soil health from contamination, some strategy should be developed, so that soil health is restored. A new technology for remediation of metals involves the use of plants is known as phytoremediation. This is a relatively inexpensive technology, since it is performed *in situ* and solar-driven. In the present investigation it is proposed to evaluate the possible plant species for phytoremediation of Vanadium and Chromium.

To assess the extent of heavy metals present in the effluent contaminated soil, the soil samples were collected randomly from the different localities of Brahmaputra valley Fertilizer Corporation Ltd. situated at Namrup, Assam, India. The collected soil samples were processed for analysis of heavy metals. Along with the soil, the vegetation grown in the effluent contaminated sites were collected to screen the heavy metals accumulator plant species for further study. The collected plant species were identified as per IPN index. The experiment on screening of heavy metal accumulating plant species is going on.

3.2.5 Technology Transfer :

Field Application of Phyto and Bioremediation technique for reducing Oil contamination Developed at IASST, Guwahati in collaboration with Oil India Limited, Duliajan, Assam.

Three plant species namely *Cyperus rotundus*, *Cyperus brevifolia* and *Axonopus compressus* were successfully applied in the contaminated field at Jorajan, Duliajan under OIL India Limited allotted to us for experimental trial of phytoremediation techniques developed at IASST. Rate of Total Oil and Grease degradation by these plant species were found to be very promising under existing ecological condition of the field. A number of oil degrading bacteria isolated from the oil contaminated site were multiplied and inoculums were also successfully applied in the field. Continuous monitoring of oil field soil and degradation by plants is continuously being monitored to record degradation of total oil and grease content. In one year 65-70% removal of contaminant has been

Figure 3.2.4 *Photograph showing vegetated area in the Experimental site at Jorajan, Oil India Limited.*

3.3 Environmental Chemistry

3.3.1 Effects of Petroleum hydrocarbons on soil enzyme activities

This research work is aimed at evaluating the impact of refinery activities on the fertility status of soils by determining the concentration levels of different physico-chemical parameters. The study also includes the determination of heavy metals, total petroleum hydrocarbons (TPH) and soil enzymatic activity of the soil. The major problems arising from the refinery activities are wastewater contains large quantities of polycyclic and aromatic hydrocarbons, phenols, metals, surface-active agents, sulphides, naphthylenic acids and other toxic chemicals. Soil enzymatic activities are sensitive biological indicators of soil pollution and could be changed under pollution stress. It is an important soil attribute and may serve as a robust measure of soil health. The present study attempts to study the pollution impact of the Bongaigaon refinery effluent as well as flaring on the nearby agricultural lands by giving emphasis on the effect of contaminants on soil enzymatic activity. Present study indicates that all the soil samples were highly contaminated by TPH.The average TPH concentration varies in the sequence west>north>south>east. This indicates that in increasing the TPH content, the effect of flaring is higher than the effect of the effluent. Contamination is higher in pre monsoon season than the post monsoon. It may be due to the fact that in the post monsoon season the rain may wash away the contamination from the soil.

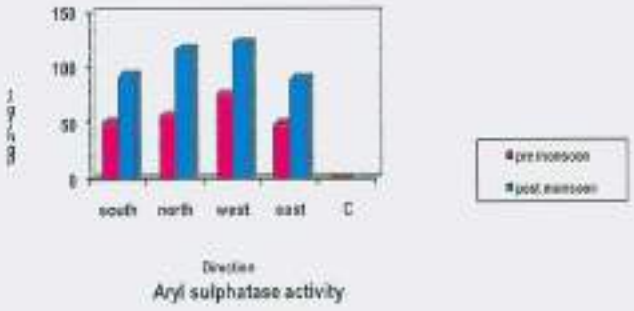


Figure 3.3.1. *Average arylsulphatase activity (ASA) in all the four directions are shown graphically*

- Arylsulphatase activity for both the season followed the same sequence west> north> south> east
- Activities were higher in post monsoon season than the pre monsoon
- These findings are similar to those of Birch (1958) and Jenkinson (1966) who reported that arylsulphatase activity increased largely in wet conditions due to more mineralization of organisms killed or damaged in dry season.
- Cooper (1971) also reported that during rainy season, when soils were continually moist, activity increased, but at the end of the rainy season, as the soils dried out, aryl sulphatase activity was again reduced.

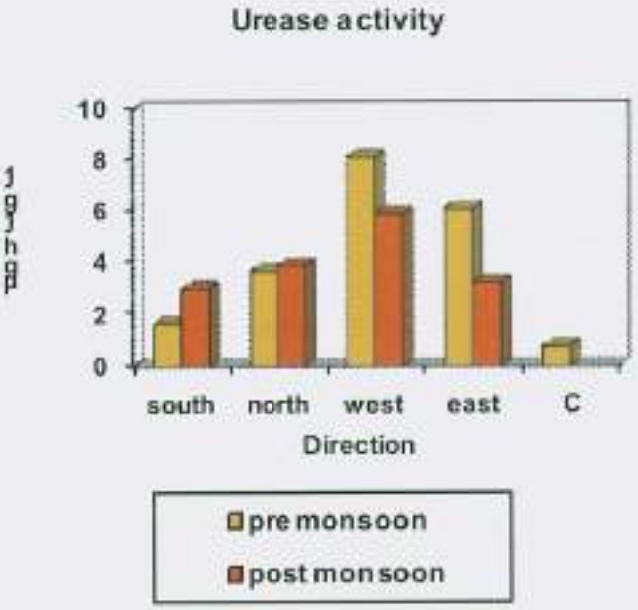


Figure 3.3.2. Average urease activity (UA) in all the four directions are shown graphically

- The changes of urease activity were not uniform in both the seasons
west>east>north>south in pre monsoon
West>north>south>east in post monsoon
- Activities were lower in post monsoon season in the west and the east direction
- This seasonal variation may depend on the urea fertilizer applied on the soil for the cultivation

Table 3.3.1 Correlation coefficient between TPH, ASA and UA (pre monsoon)

		ASA	UA	
South	ASA	1		
	UA	-0.756	1	
	TPH	0.985*	-0.634	1
North	ASA	1		
	UA	-0.827	1	
	TPH	1.000*	-0.956*	1
West	ASA	1		
	UA	-0.715	1	
	TPH	0.787**	-0.998*	1
East	ASA	1		
	US	-0.879	1	
	TPH	0.999*	-0.894*	1

r (correlation coefficient are significant at $p<0.05$ (*) or $p<0.01$ (**)

Table 3.3.2 Correlation coefficient between TPH, ASA and UA (post monsoon)

		ASA	UA	
South	ASA	1		
	UA	-0.999*	1	
	TPH	0.998*	-1.000*	1
North	ASA	1		
	UA	-0.827	1	
	TPH	0.984*	-0.724*	1
West	ASA	1		
	UA	-0.715	1	
	TPH	0.994**	-0.636*	1
East	ASA	1		
	US	-0.879	1	
	TPH	0.882*	-1.000**	1

r (correlation coefficient are significant at $p<0.05$ (*) or $p<0.01$ (**)

3.3.2 Volatile Aromatic Hydrocarbon Content of Lakowa oil Field Spillage Site, Assam

Crude oil is a complex mixture of tens of thousands of hydrocarbons and a significant amount of non hydrocarbons. A good knowledge of this hydrocarbon and non hydrocarbon contents and their behaviour when discharged on soil is very useful in the decontamination and effective management of the affected environment. An important group of the hydrocarbon content of crude oil is the Benzene Toluene Ethylbenzene and Xylene (BTEX), loosely called aromatic hydrocarbons in the oil industry to differentiate them from the polycyclic aromatic hydrocarbons (PAH) since each behaves differently in any environmental matrix. The BTEX form a group of aromatic hydrocarbons that behave alike in the soil. They have been found to degrade easily by microbes compared to the PAHs.). In this study, we have undertaken to study the distribution of BTEX in the lakowa oil field at a distance of 25m away from the Group Gathering Station

The study area is an oil spillage site located in Lakowa oil field. The spillage was due to accidental leakage from the Group Gathering station. Fingerprints of the Lakowa oil spill showed a high level of benzene with low level of o-xylene.

Table 3.3.3 ***Fingerprints of the aromatic BTEX components of the soil collected from Lakowa oil field at a distance of 25m away for the GGS.***

Components	(mg/kg)
Benzene	54.23
1,3 Dichlorobenzene	26.53
1,2 Dichlorobenzene	15.86
m,p-xylene	14.36
Toluene	13.66
Chlorobenzene	6.32
Ethyl benzene	5.42
1,4 Dichlorobenzene	4.51
o-xylene	2.06

3.3.3 Under nutrition among pregnant woman in Assam: An analysis of anthropometric, diet and bio-chemic determinants.

To ascertain the health and nutritional status of Pregnant women, a number of biochemical parameters were tested. Blood samples of approximately 1 ml were collected from 285 pregnant women and estimation of Fe, Cu, Ca and Zn of the whole blood samples were determined by using Atomic Absorption Spectrophotometer-7000(SHIMADZU) and compared with the literature results [Cu 0.8-2, Fe 420-560, Zn 6-7, Ca 80-110 in mg/L] The blood samples analyzed showed a high degree of inadequacy in almost all micronutrients (iron 69.8%, calcium 44.6%, copper 39.8% and zinc 33.7%) studied in our survey. The study further revealed inadequate dietary intake, especially micronutrient deficiency.

Table 3.3.4 Concomitant prevalence of micronutrient deficiencies amongst the pregnant women surveyed

Concomitant prevalence	Combination	n	%
Two micronutrient deficiencies	Fe+Zn	13	2.83
	Fe+Ca	155	33.70
	Fe+Cu	129	28.04
	Zn+Ca	9	1.96
	Zn+Cu	10	2.17
	Ca+Cu	89	19.35
Three micronutrient deficiencies	Fe+Zn+Ca	7	1.52
	Fe+Zn+Cu	6	1.30
	Zn+Ca+Cu	5	1.09
	Fe+Ca+Cu	59	12.83
Four micronutrient deficiency	Fe+Zn+Ca+Cu	3	0.65

4.Mathematical Sciences Division

The Mathematical Sciences Division is carrying out basic research on selected thrust areas and some database research work has been done on the problems related to the North-East region time to time from its inception. At present the members of the division are engaged in investigating certain problems in the areas of Sequence Spaces, Summability Theory, Spectral Theory, Fuzzy Mathematics, Applied Stochastic Process, Image Processing of Medical Data, Theoretical Plasma Physics and Numerical Computations.

4.1 Sequence Spaces, Series, Summability Theory

Let X be a non empty set. Then a family of sets $I \subset 2^X$ (power sets of X) is said to be an *ideal* if I is additive (*i.e.* $A,B \in I \Rightarrow A \cup B \in I$) and hereditary (*i.e.* $A \in I, B \subset A \Rightarrow B \in I$). *A non- empty family of sets* $\Im \subset 2^X$ is said to be a *filter* on X if and only if $\varnothing \notin \Im$, for each $A,B \in \Im$ we have $A \cap B \in \Im$ and for each $A \in \Im$ and $B \supset A$, implies $B \in \Im$.

A subset E of N is said to have ***natural density*** $\delta(E)$ if $\delta(E) = \lim_{n \to \infty} \frac{1}{n} \sum_{k=1}^{n} \chi_E(k)$ exists. A sequence (x_k) is said to be **statistically convergent** to L if for every $\varepsilon > 0$, $\delta(\{k \in N: |x_k - L| \geq \varepsilon\}) = 0$. We write stat-lim $X_k = L$.

An Orlicz function is a function $M: [0,\infty) \to [0,\infty)$ which is continuous, non-decreasing and convex with $M(0)=0$, $M(x)>0$, for $x>0$ and $M(x) \to \infty$, as $x \to \infty$.

The notion of difference sequence was studied at the initial stage by *H. Kizmaz [Canad. Math. Bull., 24:2(1981), 169-176]*. This notion was generalized by *M. Et and R. Colak, [Soochow Jour. Math., 21:4(1995), 377-386]* and *B. C. Tripathy and A. Esi [Internat. Jour. Sci. Tech., 1(1)(2006), 11-14]* in two different ways. *B. C. Tripathy, A. Esi and B. K. Tripathy [Soochow J. Math., 31:3(2005), 333-340]* have combined these two different notions and introduced a new notion of generalized difference sequence spaces. Lot of work has been done on this new notion, which is defined as follows…

Let m, n be non- negative integers, then for Z a given sequence space we define

$$Z(\Delta_m^n) = \{x = (x_k) \in w : (\Delta_m^n x_k) \in Z\}$$

where $\Delta_m^n x = (\Delta_m^n x_k) = (\Delta_m^{n-1} x_k - \Delta_m^{n-1} x_{k+m})$ and $\Delta^0 x_k = x_k$ for all $k \in N$. When $n=1$, we denote by $Z(\Delta_m)$ and for $m=1$ we denote by $Z(\Delta^n)$.

4.1.1. On Classical Sequences

(*i*) On *n*-normed sequence spaces

In 1989, on generalizing the notion of 2-normed spaces, A. Misiak [*Math. Nachr.*, 140(1989), 299-319] introduced the notion of *n*-normed spaces.

Applying the definition of *n*-norm, we have introduced the sequence spaces $(M\Delta^s_r, ., p, \|.,.,.,.\|)_0$, $(M\Delta^s_r, ., p, \|.,.,.,.\|)_1$, $(M\Delta^s_r, ., p, \|.,.,.,.\|)_\infty$, $(M\Delta^{(s)}_r, ., p, \|.,.,.,.\|)_0$, $(M\Delta^{(s)}_r, ., p, \|.,.,.,.\|)_1$ and $(M\Delta^{(s)}_r, ., p, \|.,.,.,.\|)_\infty$ sequence spaces in the article B.C. Tripathy and H. Dutta [*Kyungpook Math. Jour.*; 50(2010), 59-69]. It is shown that the classes of sequences $(M\Delta^s_r, ., p, \|.,.,.,.\|)_0$, $(M\Delta^s_r, ., p, \|.,.,.,.\|)_1$, $(M\Delta^s_r, ., p, \|.,.,.,.\|)_\infty$ are paranormed spaces, paranormed by g defined by

$$g(x) = \sum_{k=1}^{r} \|x_k\| \cdot \inf\left\{\rho^{\frac{p_k}{H}} : \sup_k M\left(\left\|\frac{\Delta^s x_k}{\rho}, z_1, \ldots, z_{n-1}\right\|\right) \le 1\right\}$$

where $H = \max(1, \sup_{k \ge 1} p_k)$ and $\|.\|$ is the derived 1-norm (norm) on X.

When $(X, \|.,.,.,.\|)$ is an *n*-Banach space, these spaces are complete paranormed spaces paranormed by *g*. Taking $p_k = 1$ for all $k \in N$ and $(X, \|.,.,.,.\|)$ an *n*-Banach space we have established that these spaces are *n*-Banach spaces. Different topological properties of these space have been proved.

(*ii*) On *I*-acceleration Convergence

The notion of acceleration convergence of sequences was investigated by D.A. Smith and W.F. Ford [*Siam. J. Numer. Anal.*, 16(2), (1979), 223-240], T.A. Keagy and W.F. Ford [*Pacific Jour. Math.*, 132 (2) (1988), 357-362] and others. B.C. Tripathy and M. Sen [*Italian J. Pure Appl. Math.*, 17(2005), 151-158] have introduced and investigated the notion of statistical acceleration convergence of sequences. We have introduced the notion of *I*-acceleration convergence of sequences in the paper B.C. Tripathy and S. Mahanta [*Jour. Franklin Inst.*, 347(2010), 591-598] and investigated different properties, both from general as well as from matrix transformation point of view. The introduced notion generalizes and unifies several notions of acceleration convergence of sequences. The decomposition result is proved and the following important results have been established.

Result 1. Let $(x_k) \in S^I_0$ (the class of bounded *I*-null sequences with nonzero terms) and A be a subsequence transformation. If A accelerates (x_k) with respect to I, then there exists $(y_k) \in S_0$ (the class of bounded null sequences with nonzero terms) such that $x_k = y_k$ for almost all k relative to I, and A accelerates (y_k).

Result 2. Let $(x_k) \in S^I_\infty$ and A be a subsequence transformation. Then A accelerates (x_k) with respect to I if and only if there exists a subsets $D = \{k_i : i \in N\}$ of N such that $D \in F$ and A accelerates (x_{k_i}).

Result 3. Let $x = (x_k) \in S^I_0$ and A be a subsequence transformation such that $Ax \prec^I x$. Then there exists $y = (y_k) \in S^I_0$ such that $(x_k) \prec^I (y_k)$ and A accelerates (y_k).

4.1.2. On Sequences of Fuzzy Numbers

A fuzzy real number X is fuzzy set on R and is a mapping $X: R \to J (=[0,1])$ associating each real number t with its grade membership $X(t)$. We have considered $R(J)$, the set of all *uppersemi continuous*, *normal* and *convex* fuzzy real numbers for our study.

(*i*) Lacunary Genwralized Difference Sequrnces of Fuzzy numbers.

In the paper B.C. Tripathy and A. Baruah [*Kyungpook Math. Jour.*, 50(4)(2010), 565-574], we have introduced the following definitions.

Let $\theta = (k_r)^\infty_{r=0}$ be a lacunary sequence and d be a metric on $R(J)$. A sequence $X = (X_k)$ of fuzzy numbers is said to be lacunary Δ^n_m-statistically convergent to a fuzzy number X_0 if for every $\varepsilon > 0$, $\lim_{r \to \infty} h_r^{-1} |\{k \in I_r : d(X_k, X_0) \ \}| = 0$. We denote this by $X_k \to X_0 (S_\theta(\Delta^n_m))$.

Let $\theta=(k_r)^{\infty}_{r=1}$ be a lacunary sequence, $X=(X_k)$ of fuzzy numbers and $p=(p_k)$ be any sequence of positive real numbers. Then the sequence X is said to be lacunary $\Delta^n_m(p)$- convergent if there is a fuzzy number X_0 such that

$$\lim_{r\to\infty} h_r^{-1}\sum_{k\in I_r}\left[d\left(\Delta^n_m X_k, X_0\right)\right]^{p_k}=0.$$

We write $X_k\to X_0(N_\theta(\Delta^n_m,(p)))$. When $\theta=(2^r)$, we denote $(N_\theta(\Delta^n_m,(p)))$ by $|\sigma(\Delta^n_m,(p))|$ and for $p_k=p$, for all $k\in N$, we denote $N_\theta(\Delta^n_m,(p))$ by $N_\theta(\Delta^n_m,p)$.

We have proved that the classes of sequences

$\ell\infty(\Delta^n_m,(p)),\sigma\Delta^n_m,(p)),N_\theta(\Delta^n_m,(p))$ are closed under addition and scalar multiplication. We have shown that the class of sequences $N_\theta(\Delta^n_m,(p))$ is neither solid nor symmetric nor convergence free. We have proved some inclusion results involving these classes of sequences of fuzzy numbers.

(*ii*) Nörlund and Riesz Mean of Sequences of Fuzzy Real Numbers

Let (p_n) be a sequence of non-negative real numbers which are not all zero and $P_n=p_1+p_2+p_3+\cdots+p_n$, for all $n\in N$. We introduce the following definitions in our article B.C. Tripathy and A. Baruah [*Applied Mathematics Letters*, 23(2010), 651-655].

A sequence (X_n) of fuzzy real numbers is said to be summable by Nörlund mean (N, P_n) to L, if

$$\bar{d}\left(\frac{1}{P_n}\sum_{i=1}^{n}P_{n-i+1}X_i, L\right)\to 0, \text{ as } n\to\infty .$$

A sequence (X_n) of fuzzy real numbers is said to be summable by Riesz mean (R, P_n) to L, if

$$\bar{d}\left(\frac{1}{P_n}\sum_{i=1}^{n}P_{n-i+1}X_i, L\right)\to 0, \text{ as } n\to\infty .$$

A sequence (X_n) of fuzzy real numbers is said to be slowly oscillating if $\bar{d}(X_m, X_n)\to 0$, as $m, n\to\infty$ with $1\le\frac{m}{n}\to 1$.

We have established the following main results.

Result 1. *(N, P_n) method transform convergent sequences of fuzzy real numbers in to convergent sequence of fuzzy real numbers if and only if* $\frac{P_n}{P_n}\to 0$, *as* $n\to\infty$.

Result 2. *(R, P_n) method transforms convergent sequences of fuzzy real numbers into convergent sequence of fuzzy real numbers if and only if $P_n\to\infty$, as $n\to\infty$.*

Results 3. *If (X_n) is (R, P_n) summable to L in $R(J)$ and is slowly oscillating then it is converges to L in $R(J)$.*

Result 4. *Let (n_k) be an increasing sequence of natural numbers and (X_n) be a sequence of fuzzy real numbers such that $X_n=$ for $n_k<n<n_{k+1}$. If (X_n) is (R, P_n) summable to L in $R(J)$, then (X_n) converges in $R(J)$ to L provided* $\lim\frac{n_{k+1}}{n_k}>1$.

4.2. Applied Stochastic Process.

Queueing theory is a branch of Applied Stochastic Process. In this context, some investigations have been made on different branches of queueing theory such as *Retrial models* and *Control of queues*.

4.2.1. Work done on Retrial Models

During last two decades there have been considerable attention paid to the analysis of queueing systems with repeated attempts (or retrial queues).Retrial queues are characterized by the following feature that a customer who finds the server busy upon arrival is obliged to leave the service area to repeat his demand after some random amount of time called ***retrial time***. Between trials, the blocked customer joins a pool of unsatisfied group of customers called "***orbit***" or "***retrial group***". The pioneering studies of retrial queues are to present the concept of retrial time as an alternative to the classical model of telephone systems. In this context each block customer generates a stream of repeated requests independently of the rest customers in the retrial group. Thus, in the so called ***classical retrial policy***, the interval between successive repeated attempts are exponentially distributed with rate (say), when the number of customers in the retrial group (orbit) is 'n'. This type of model has been studied by ***Yang and Templeton [QUESTA, 2 (1987), 201-233]*** and ***Falin [QUESTA, 7(1990), 127 168].*** Again many authors have investigated system with a repairable service station where in the service channel is subject to breakdown from time to time or some other kind of service

interruptions. Recently, ***Wang et.al* [*QUESTA*, 8(2001), 363-380]** studied a repairable retrial queueing model from the view point of reliability viewpoint for first time, both the queueing indices and reliability characteristics are obtained. In this context, we have ***G.Choudhury, L.Tadj and K.Deka* [# Computers and *Mathematics with Applications*, 59 (2010), 437 450 #]** generalized the above model for the case of type of retrial queue with two phases of service for unreliable server, where concept of Bernoulli admission mechanism is also introduced. Our investigation includes stationary distribution of the state of the server and number of customers in the orbit. Further, some important performance measures and some reliability indices are also obtained. More over, we have developed an optimal design to observe the effects different parameters under a suitable linear cost structure.

Wide classes of policies for governing the vacation mechanism with retrials have been discussed recently in the literature. Bernoulli vacation model is one of the important vacation model with non-exhaustive service: The classical vacation scheme with Bernoulli schedule discipline was introduced and studied by ***Keilson and Servi* [*Journal of Applied Probability*, 23(1986), 790-802]**. In their model of , a single channel goes on vacation when the system becomes empty. The server keeps taking vacations until at least one unit is present in the system upon completion of a vacation period. If on service completion the system is not empty, the server goes on vacation with probability and resume service with probability .In this we have invested such models for Batch service systems for unreliable server.

4.2.2. Work done on Control of Queues:

Control of queue is one of the most significant area of research. It is customary to classify models into two general categories: descriptive and prescriptive models. Descriptive models are models which describe some current real world situation, while prescriptive models are models which prescribe what real world situation should be, that is, optimal behavior at which to aim.

The determination of an optimal policy for a queueing system is an important issue. This is usually done by developing the total expected cost function per unit time for the system and then deriving the relevant optimal system parameters. In this context our aim is to provide complete analysis including the optimization problem of the two phase service system for unreliable server under Bernoulli vacation model.

4.3. Image Processing

On Pattern Recognition and Machine Learning Models with application to real life problems related to Cancer data and development of Algorithm based on Pearsonian System of Curves.

PAP smear is an efficient test to detect any abnormality in cervical cells which can lead to cervical cancer. But the manual screening process is highly susceptible to erroneous result. We developed a method for automated classification of the digitized PAP images to assist the pathologists in identification of suspicious samples. The microscopic images are stored in RGB format and analyzed with Fuzzy-c-mean algorithm and generalized shape theory. The results are validated with the pathological tests and doctor's opinion and it yields good results.

To find out the difference inside the image, we consider the image as a set of data having pixel value R, G and B. These datasets ($x1, x2, \ldots, xn$) are classified using Fuzzy-c-mean (FCM) algorithm to identify the different regions inside the images namely cytoplasm and nucleus. To initiate the clustering process we generate random numbers corresponding to each of the R, G and B value. Three kinds of random number generator are used; general random number generator, chaos function and chaos function with timestamp. These random numbers constitute the membership value (μ) of the pixels. The μ value of the pixels are compared with that of the cluster center and classified accordingly. The clustering process segments the images namely into three classes: cytoplasm, nucleus and the background. The clustering process is validated using three parameters. The closeness of the input samples are measured by partition coefficient defined as

$$F(U,c)=\frac{1}{n}\sum_{i=1}^{c}\sum_{k=1}^{n}(\mu_{ik})^2$$

where $U = [u_{ik}]$ is a $c \times n$ *matrix* , *where* u_{ik} is i^{th} membership value of the k^{th} input sample X_k

c = number of cluster, n = number of datasets, $u_{ik} = i^{th}$ membership value of the k^{th} input sample X_k.

The second parameter partition entropy is defined by

$$H(U,c) = -\frac{1}{n}\sum_{i=1}^{c}\sum_{k=1}^{n}\mu_{ik}\log(\mu_{ik})$$

The compactness and separation validityfunction is defined as

$$S(U,c) = \frac{\frac{1}{n}\sum_{i=1}^{c}\sum_{k=1}^{n}\mu_{ik}^{2}\left|x_k - v_i\right|^2}{\min_{i,j}\left|v_i - v_j\right|^2}$$

Generalized shape theory is used to study the shape and size of the nucleus. The perception of shape has been used for pattern recognition, computer vision, shape analysis, and image registration. Here we consider shape analysis and shape based similarity measures based on Dutta Majumder's *generalized shape theory*. Shape distance and *shape metric* approach. The *Generalized shape theory* uses co-ordinate transformation of landmark points of the ROI in the respective images. Where as *shape metrics* and *shape distance* uses degrees of match between the corresponding shapes of the two nucleus images.

We have developed software for automatic analysis of the Pap smear images. Cytological image are the microscopic image of cells. Digital images are taken with a high resolution camera mounted on the microscope. The software is capable of reading the images and carrying out various images processing task such as edge detection, segmentation, extraction of object properties etc. Some screenshots of the software are given below

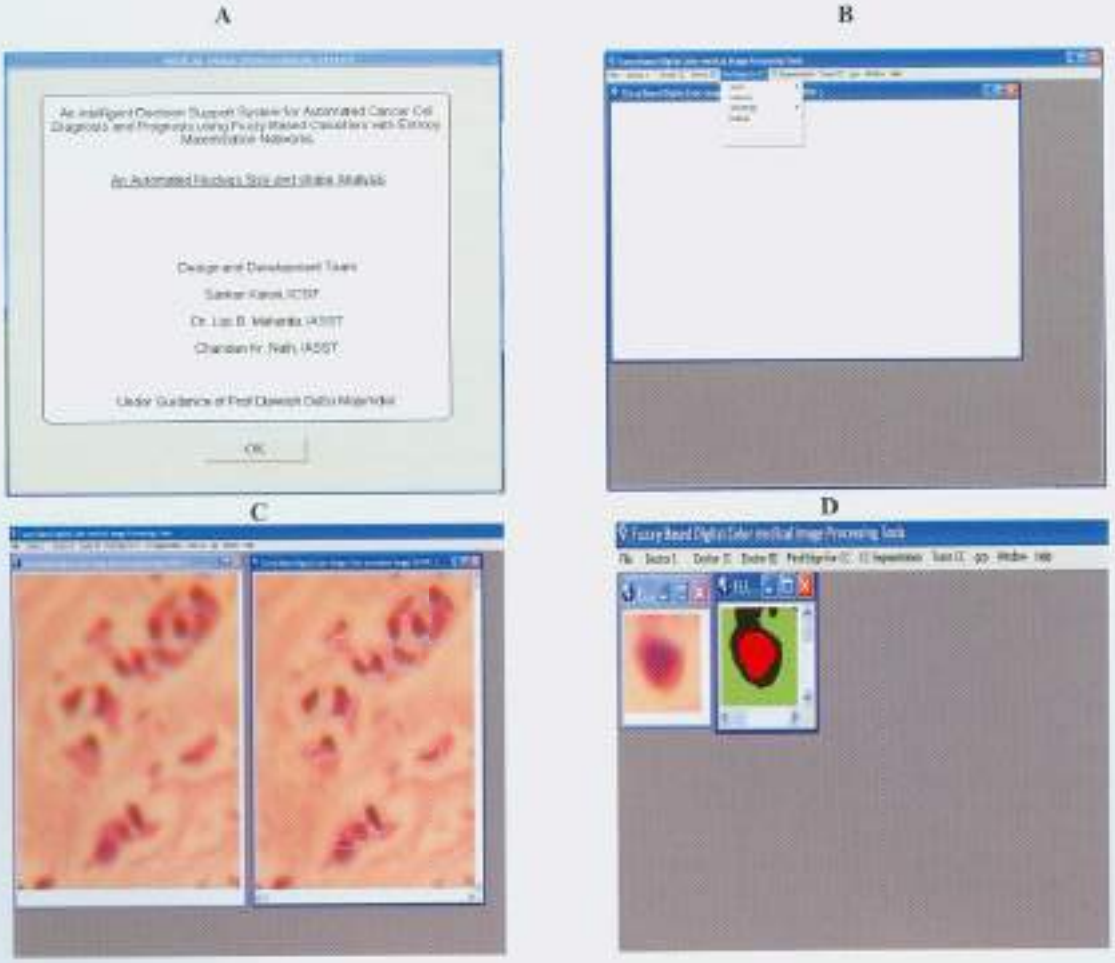


Figure 4.3.1 *Snapshot of the software (A) Welcome Window (B) Edge Detection Window (C) Carcinoma Tracing Window (D) Cell Segmentation Window*

The software automatically generates a report containing the details of size and arrangement of the cells. The sizes are calculated in terms number of pixels. The shape of the nucleus can interpreted from the data generated by the report. The carcinoma ratio refers to the nucleus-cytoplasm area ratio and we generalized the value as -1 for suspicious samples.

Name.....
Date.....

Report

Cytoplasm Area	:	**932**
Cytoplasm maximum width	:	**29**
Cytoplasm maximum height	:	**44**
Nucleus area	:	**645**
Nucleus maximum width	:	**79**
Nucleus Maximum height	:	**44**

Arrangement of the nucleus and the cytoplasm is: Abnormal

Carcinoma ratio	:	**-1**

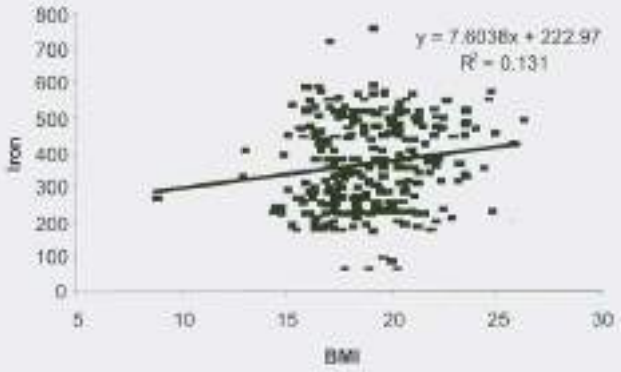
(Signature)

Figure 4.3.2. *Automatically generated report.*

4.4. On Statistical Data Analysis

Anthropometric, Diet and Biochemical markers of nutrition as regards pregnant women: a statistical analysis.

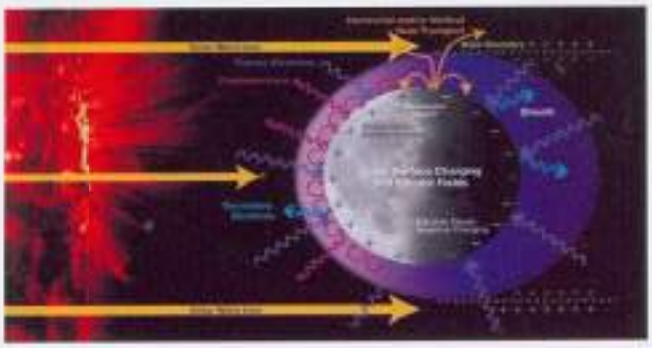
Malnutrition is the insufficient, excessive or imbalanced consumption of nutrients. The World Health Organization cites malnutrition as the gravest single threat to the world's public health. Improving nutrition is widely regarded as the most effective form of aid. It is a burning global problem, mostly in developing countries. To check this problem it is of vital importance to monitor the status of the pregnant women in every region. Our study proposed to find out the status of under nutrition of pregnant women in the district of Kamrup, Assam, India and also to evaluate the factors responsible for their status. A cross sectional study using multistage sampling design with probability proportional to size was made of 460 pregnant women belonging to low socio-economic status were selected as sample, as such women are more prone to under nutrition. Responses regarding their socio-economic, socio-cultural, health, diet and environmental background were collected and coded. It was found that there was very high percentage (43.5%) of under nutrition (BMI) amongst the pregnant women. The blood samples analyzed showed a high degree of inadequacy in almost all micronutrients (iron 69.8%, calcium 44.6%, copper 39.8% and zinc 33.7%) studied in our survey. The study further revealed inadequate dietary intake, especially micronutrient deficiency. Various statistical methods were utilized to arrive at the results. Apart from standard tests like crosstab analysis, ANOVA etc, Bivariate Logistic Regression tests revealed that factors like religion, community, size of family, social taboos, peer support, anger and living conditions like type of house and source of drinking water affected the status of the women significantly. The relationships of BMI level with Iron levels in blood were identified as follows:

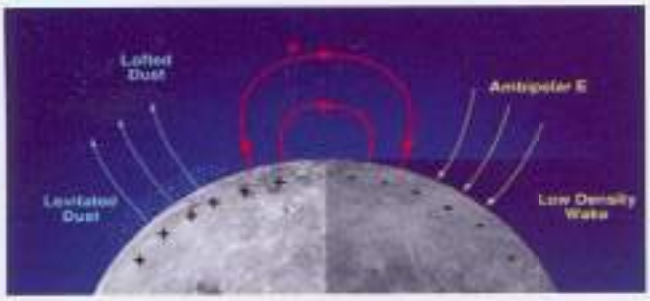


4.5 Theoretical Plasma Physics

Our main study aims on the planetary motion around the Sun followed by the observations on sheath formation on Moons of the planets (which has already been predicted by the satellite observations), and thereafter to find the dynamical behaviors of the dust grains into the sheath (levitated from the surface of the Moon). For brevity, the study has been done (in studying sheath formation) with the estimation done with the appropriate data input from the Moon. Later the dust dynamics, levitated into sheath and its stability in finding the dust cloud clustering as Nebulon has been studied, and could be of interest in furthering the observations in the

formation of nebulons around the solid body immersed in galaxy, Saturn ring, etc. Overall studies need to find the dust sizes levitated from the Moon's surface and trapped into the sheath region, and the forces generating on dust grains as shown below by the NASA Satellite observations.





Based on above evidences, our motivation relies to study sheath formation and other nonlinear waves in spaces around the earth's moon surface relying on the satellite observations on the orbital motion of the celestial bodies in spaces. We, based on some observations, find that the controversial arguments yield different nature of sheath formation on the surface of Moons in spaces. Further, satellites predict the injection of dust grains from the surface of the solid body (Moon) and cause the finding of nebulons: formation of dust atmosphere, what exactly is our ongoing research. Overall studies based on the basic governing equations supported by the Maxwell equations can be written as

$$\frac{\partial \overline{n}_\alpha}{\partial \overline{t}} + \nabla.(\overline{n}_\alpha \overline{v}_\alpha) = 0 \qquad 1$$

$$\frac{\partial \overline{v}_\alpha}{\partial \overline{t}} + \overline{v}_\alpha (\nabla.\overline{v}_\alpha) = q_\alpha \frac{E}{m_\alpha} + \left(\frac{q_\alpha}{m_\alpha}\right)\left[(\overline{v}_\alpha \times H_0) + (\overline{v}_\alpha \times 2\Omega m_\alpha / q_\alpha)\right] \qquad 2$$

$$\frac{\lambda_d^2}{\rho^2}\left(\frac{\partial^2 \Phi}{\partial x^2}\right) = n_e - n \qquad 3$$

A special method has been employed to derive sheath equation in plasma constituent embedded with magnetic field H_0 and rotating with uniform angular velocity Ω as

$$\frac{1}{2}A(n)^2\left(\frac{d\Phi}{d\xi}\right)^2 = (1+\eta)^2 \left[F(\Phi) - \Phi - \frac{BF(\Phi)^2}{2} + M^2\left\{B\Phi + \frac{1-BF(\Phi)}{F'(\Phi)} - \frac{1}{2F'(\Phi)^2} - \frac{1}{2}\right\}\right]$$

with

$$V(\Phi, M, 0) = -(1+\eta)^2 \left[F(\Phi) - \Phi - \frac{BF(\Phi)^2}{2} + M^2\left\{B\Phi + \frac{1-BF(\Phi)}{F'(\Phi)} - \frac{1}{2F'(\Phi)^2} - \frac{1}{2}\right\}\right]$$

where

$$F(\Phi) = \int_0^\Phi n d\Phi \,.\, F'(\Phi) = n, B = \frac{\cos^2\theta}{M^2}$$

are used.

Numerical analyses have been employed to solve for finding the sheath formation over the Moon. However, the same wave equation has been solved analytically, considering the nonlinear ordering effects, to determine other nonlinear waves such as soliton, double layers, and shock phenomena for different nonlinear wave pulses in the plasma medium. Evidences generated earlier controversial arguments on Earth's Moon which does not have any magnetic field and causeway our investigations have been taken up in unmagnetised plasma model, and merit of the results published recently in Astrophysics and Space Sciences **332**, 301 (2011).

In continuation, based on recent NASA Report (2007) saying that Earth's Moon has magnetic field of order (0-100) nano Tesla, we remodeled our mode of studies with the due consideration of magnetic field which enables us to find the different salient features of sheath formation on Moon and thus the formation of nebulons. We find that dust sizes of order of 1-2 μm are generating on Moon's surface forming the nebulons.

Thus study evidences rotation and magnetic field has the interaction on the stability of nebulons with different dust grain sizes. Finally the study concludes, observations find importance on the interaction of magnetic field and rotation in spaces without which, study might be deprived of many important observations on other Moons (Part of the works has been accepted for its publication in Astrophysics and Space Sciences).

5. Knowledge Resource Center

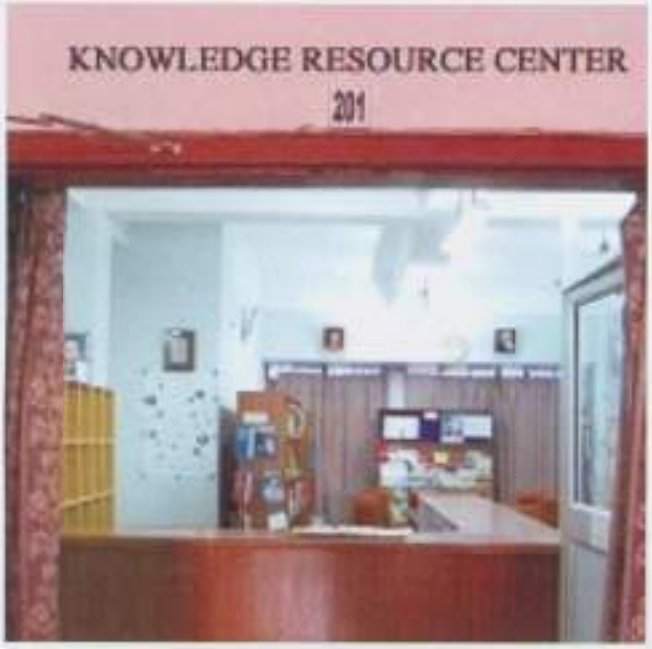
The Knowledge Resource Center (KRC), IASST formerly known as IASST Library which started its humble beginning since the inception of the institute, in the year 1979, has now been developed to a full-fledged Knowledge Resource Center. The KRC is equipped with its rich knowledge based resources and equipments and offers services to the users. The KRC is primarily meant for the use of its research staff i.e. faculty members, research scholars and staff of the institute. It is also frequently used by the faculty members and research scholars of other institutes and universities located in Assam and North East India.

The resources of this center are books, journals, bound periodicals, research papers mainly related to the subjects of physical science, life science, computational & numerical studies, instrumentation and also some reference collections.

Resource Development:

During the period 2010 - 2011, the following information resources were added:-

- Books: 118
- Subscription to Journals: 61 (Print + Online)
- Total collection of books at the end of the period: Around 7946
- Total collection of bound periodicals at the end of the period: Around 1008



Subscription:

The library subscribed for 61 scientific journals both Indian & Foreign and 7 national and local newspapers. Out of 61 journals some are online accessibility. Besides this, library received the annual report, newsletter, bulletin, and progress report from different organizations as a gratis/exchange document.

Services and facilities:

•Visitors using the Library	**...**	**490**
• Circulation of Books/Journals etc'	....	806
• Photocopying (No. of pages)	....	50803
• Number of Annual Reports mailed.		83
• No. of INTERNET Search provided.		213
• Current Awareness Service.		51
• Selective Dissemination Information Service		36
• Referral Service		108
• Resource Sharing		07
• Preparation of serials holding list	..	Completed

Digital Library activities:

In the KRC a digital library has been constructed with the help of Dspace Digital Library Software which is known as Pragya: the Digital Repository of the Institute of Advanced Study in Science and Technology (IASST). The works of Digital Repository including scholarly output of the faculties and other miscellaneous publications are going on. Action has been initiated for digitization of research papers which are not available in a soft copy. Digitization of annual report of the institute has been completed.

Consortia:

The KRC is a member of National Knowledge Resources Consortium (NKRC). The KRC are getting full text access to several E- journals and database services from IOP, ACS, AIP, CUP, T&F, Emerald and SciFinder etc through this consortium and these E-journals are available at KRC home page.

Modernization:

The new version SOUL 2.0 library management software has been installed in the newly purchased HP Tower model server and all the data has transferred from SOUL 1.0 to SOUL 2.0 software successfully. A website of KRC at Google site http://sites.google.com/site/iasstlibrary has been constructed and users of the institute can browse Pragya: the Digital Repository of the Institute of Advanced Study in Science and Technology (IASST) through this site. Of course this KRC site will be transferred to the institute website at the earliest. The bar-coding of books as well as the issuing of bar-code generated KRC membership card is going on. The KRC is now ready for computerized circulation service including some other services. The OPAC (bibliographic information about KRC books) service is ready to the users in the KRC premises. The list of research publication, list of current periodicals, list of back volumes are also available at KRC site.

Research Methodology Portfolio/ Archival:

The KRC is planned to construct a research methodology portfolio/ archival for keeping data as archival collection of all experimental data, survey data, analytical data, data on relevant research works including local seminars, class works, workshop, presentations etc of scientists and research scholars of the institute.

6. Projects

6.1 Ongoing projects

Project - 1. *Development of Polymer Based Sensors.*
Funded by MCIT, Department of Information Technology, DIT, Govt. of India.
Project cost: ₹ 79.71 Lakh,
Duration- (2011-2014)
Principal Investigator: Dr. Neelotpal Sen Sarma
Co-Principal Investigator: Dr. Devasish Chowdhury

Project - 2. *Development of proton exchange membrane for fuel cell by plasma process.*
Funded by Ministry of new and Renewable Energy, Government of India.
Project cost: ₹ 58.90 Lakh
Duration (2010-1013)
Principal Investigator: Prof. Joyanti Chutia
Co-Investigators: Dr. A. R. Pal, Dr. H. Bailung, Dr. N. C. Adhikary, Dr. N. S. Sarma and Dr. D. Chowdhury
JRF: Mr. Bhabesh Kumar Nath

Project - 3. *Studies on the discharge characteristics of pulsed plasma system for synthesis of conducting polymer films.*
Funded by the Department of Science and Technology, Government of India under Fast Track Scheme.
Project Cost ₹ 19.35 Lakh
Duration (2009-2012)
Principal Investigator: Dr. Arup Ratan Pal

Project - 4. *Development of nanocomposite material based organic-inorganic hybrid flexible solar cell by plasma polymerization and magnetron sputtering combined process.*
Funded by the BRNS, Department of Atomic Energy (DAE), Govt. of India
Project Cost ₹ : 19.01 Lakh
Duration (2010-2013)
Principal Investigator: Dr. A R Pal
Co-Investigators: Prof. Joyanti Chutia,
Dr. H. Bailung
Principal Collaborator: Prof. D. S. Patil, BARC Mumbai
JRF: Ms. Shyamalima Sharma

Project - 5. *Assessment of impact of anthropogenic activities on soil/water and certain medicinal plants species in and around Bharalu River in Guwahati city.*
Funded by Ministry of Environment & Forest, GOI
Project Cost ₹.18.69 lakh
Duration: 2010-2013
Principal Investigator: Dr. Jibon Kotoky
JRF: Ms. Ananya Barman

Project - 6. *Assessment of Risk due to intake of artificial food colours through foodstuffs available in the N.E. Region including Sikkim.*
Funded by North Eastern Council, Shillong, Govt. of India.
Project Cost ₹ .24.87 lakh
Duration: 2010-2013
Principal Investigator: Dr. Jibon Kotoky
JRF: Mr. Manashjyoti Deka
JRF: Ms. Susmita Bose Roy

Project - 7. *Plant-Diversity and Environmental study by the students of Assam*
Funded by- DST, (NCSTC), govt. of India.
Project cost: ₹ 10.76 lakh
Duration : 2008-2011
Principal Investigator: Dr. Jibon Kotoky

Project - 8. *Development of a Package for seed production of Muga Silkworm*
Funded by NABARD
Project Cost: ₹ 16.60 lakh
Duration: 2008- 2011
Principal Investigator: Dr. (Mrs). Dipali Devi
JRF: Mr. Saranga Dutta
Field Assistant: Mr. Krishna Kanta Sarma

Project - 9. *Phytoremediation of hydrocarbon contaminated soil of Upper Assam*
Funded by: Ministry of Environment and Forests, Govt. of India.
Project Cost: ₹13.22 Lakh
Duration: 3 years (2007-2010)
Principal Investigator: Dr. Suresh Deka
Co-Pricipal Investigator:
Dr. Neelotpal Sen Sarma
SRF: Dr. Hemen Deka

Project - 10. *Biosurfactants and their use for recovery of hydrocarbon from refinery sludge*
Funded by: Department of Biotechnology, Govt. of India, New Delhi
Project Cost: ₹ 27.62 Lakh
Duration: 3 years (2008-2011)
Total fund: Rs. 27.62 Lakh
Principal Investigator: Dr. Suresh Deka
Co-Pricipal Investigator: Prof. K. G. Bhattacharyya
JRF: Ms. Rashmi Rekha Saikia

Project - 11. *Study of Aquatic Biodiversity in Selected Watersheds of Arunachal Pradesh, India.*
Funded by Department of Science and Technology, Govt. of India
Project Cost: ₹11.7 lakh
Duration: 2009-2012
Principal Investigator: Dr. S.C.Bordoloi
JRF: Mr.Mrinal Kumar Das
FA: Mr. Pinku Bora, Mr. Sabi Prasad Rabha

Project - 12. *Field Application of Phyto and Bioremediation technique for reducing Oil contamination Developed at IASST, Guwahati in collaboration with Oil India Limited, Duliajan, Assam.*
Funded by - Oil India Limited, Duliajan, Assam
Project Cost: ₹ 28 lakh
Duration: 2009-2011
Principal Investigator: Dr. S.C.Bordoloi
JRF: Sri Budhadev Basumatary
Sri Rubul saikia
FA: Sri Ailek Chakhap
Sri Dhaneshwar Boro

Project - 13. *Evaluation of possible candidate species for phytoremediation of vanadium and Chromium*
Funded by: Department of Biotechnology, Govt. of India (Coordinating organisation Department of Biochemistry, IISc, Bangalore)
Total Cost: ₹3.67 Lakh
Duration: 2011-13
Supervisor: Dr. Suresh Deka
Research Associate: Dr. Hemen Sarma

Project - 14. *Preparation of a Data Bank on general health status of the population in the open cast coal mining areas of Assam vis-à-vis their exposure to dust in ambient air.*
Funded by Department of Science and Technology, Govt of India
Project Cost: ₹ 12.5 lakh
Duration: 2011-2013
Principal Investigator: Dr. (Mrs.) Arundhuti Devi
Co- Principal Investigator: Prof. Krishna G. Bhattacharyya
Project Assistants: Ratul Bezbaruah and Himangshu Deka

Project - 15. *Oxidative degradation of typical petroleum hydrocarbons in soil through combined bioaugmentation and biostimulation processes.*
Funded by Department of Biotechnology, Govt. of India.
Project Cost: ₹ 16.83 lakh
Duration: 2011 - 2014
Principal Investigator: Dr. (Mrs.) Arundhuti Devi
Co- Principal Investigator: Prof. Krishna G. Bhattacharyya

Project - 16. *Studies on some pattern recognition and machine learning models with application to real life problems related to cancer data and development of algorithms based on Pearsonian system of curve.*
Funded by: Department of Science and Technology, Govt. of India
Project Cost: ₹ 11. 57 lakh
Duration: 2008-2011
Principal Investigator: Dr. Lipi B. Mahanta
Co- Principal Investigator: Dr. D.C.Nath
JRF/SRF: Mr. Chandan Nath

Project - 17. *Study on the Coherent Structure of Dust-ion-acoustic Nebulons in the interstellar space Plasma as well as on the surface of moon and rotating stars*
Project Cost: ₹ 14.31 lakh
Funded by ISRO-RESPONS
Duration: 2008-2011
Principal Investigator: Professor G.C. Das
JRF: Ms. Rupa Chakraborty

Project - 18. *Spectra and Pseudo-spectra of Euler Operator.*
Funded by Council of Scientific and Industrial Research, New Delhi.
Project Cost: ₹ 10.67 lakh
Duration: 2010-2013
Principal Investigator: Dr. B. C Tripathy
Research Associate: Dr. Amar Jyoti Dutta

Project - 19. North Eastern origin silk protein leased matrices and nano/ micropraticles for biomadiated applications
Funded by Department of biotechnology, Govt. of India
Project Cost : ₹ 44.2 Lakh
Duration : 2011-2014
Principal Investigator : Dr. Dipali Devi

6.2 Completed projects

Project - 1. *Surface self-assembly @constructive nanolithography enroute to polyaniline based nano devices.*
Funded by Department of Science and Technology, Govt. of India
Project Cost: ₹ 11.28 lakh
Duration: 2008-2011
Principal Investigator: Dr. Devasish Chowdhury

Project - 2. *Development of Liquid Crystalline Polymers.*
Funded by MCIT, Department of Information Technology, DIT, Govt. of India.
Project cost: ₹ 25.4 Lakh
Duration: 2006-2010
Principal Investigator: Dr. Neelotpal Sen Sarma
Co-Principal Investigator: Prof. Joyanti Chutia
SRF: Mr. Samiul Hoque

Project - 3. *Investigation of collective processes in laboratory dusty plasma*
Funded by Indian Space Research Organization.
Project cost ₹16.40 Lakh
Duration: 2006-2009
Principal Investigator: Dr. H. Bailung
Co-Investigator: Prof. Joyanti Chutia
SRF: Mr. Manoj Kr. Deka

Project - 4. *Basic experiments in multicomponent plasma with negative ions*
Funded by the Department of Science and Technology, Government of India.
Project Cost: ₹ 34.60 Lakh
Duration 2006-2010
Principal Investigator : Dr. H. Bailung
Co-Investigator: Prof. Joyanti Chutia
SRF: Ms. Sumita K Sharma

Project - 5. *Development of RF Plasma polymerization process for deposition of hard transparent and corrosion resistant coating on Bell metal and surface modification of muga silk fibres.*
Funded by BRNS, Department of Atomic Energy (DAE), Govt. of India.
Project Cost. ₹ 24.00 Lakh
Duration: 2007-2010
Principal Investigator: Prof. Joyanti Chutia
Co-Investigators: Dr. H. Bailung and Dr. A R Pal
Principal Collaborator, Prof. D. S. Patil, BARC Mumbai
SRF: Mr. Arup Jyoti Choudhury
Laboratory Technician: Mr. Rakesh Singh

Project - 6. *Development of broad spectrum remedy from natural sources for healthcare with special reference to skin ailments.*
Funded by DRL (DRDO) Tezpur.
Project Cost ₹ 9.98 lakh
Duration: 2007-2010.
Principal Investigator: Dr. Jibon Kotoky.
SRF: Mr. Kaustav Kalyan Sharma
Research Assistant: Mr Rubul Saikia

Project - 7. *Nutritional Status of the pregnant women in the low socio-economic areas in Kamrup District.*
Funded by : MOSPI, CSO.
Project Cost : ₹ 3.94 lakh
Duration: 2009 - 2010.
Principal Investigator: Dr. Lipi B. Mahanta
Co- Principal Investigator: Dr. A. Devi
Research Officer: Ms. Tanusree Deb Roy
Research Assistant: Ms. Rongmili Gogoi Dutta

7. Publications / Patents

7.1 In Cited journals

1. H. Bailung, M. K. Deka, N. C. Adhikary and Y. Nakamura (2010) : *Charging of micrometer sized dust grains in a low temperature and low density plasma produced using a magnetic filter*, Plasma Sources Science and Technology. **19**, 055005.

2. H. Bailung, S. K. Sharma and Y. Nakamura (2010) : *Effect of ion beam on the propagation of rarefactive solitons in multicomponent plasma with negative ions*, Physics of Plasmas. **17**, 062103.

3. Ming-Shu Kuo, A. R. Pal, G. S. Oehrlein, P. Lazzeri, and M. Anderle (2010) : *Mechanistic study of ultralow k-compatible carbon dioxide in situ photoresist ashing processes. I. Process performance and influence on ULK material modification, J. Vac. Sci. Technol. B.* **28**, 952.

4. Ming-Shu Kuo, A. R. Pal, G. S. Oehrlein, and Xuefeng Hua (2010) : *Mechanistic study of ultralow k-compatible carbon dioxide in situ photoresist ashing processes. II. Interaction with preceding fluorocarbon plasma ultralow k etching processes, J. Vac. Sci. Technol. B.* **28**, 961.

5. Paresh Chakravarty, N. Sen Sarma and H.P. Sarma (2010) : *Biosorption of cadmium (II) from aqueous solution using heartwood powder of Areca catechu*, Chemical Engineering Journal. **162**, 949.

6. Samiul Hoque, Narendra Nath Dass and Neelotpal Sen Sarma (2011): *Reactivity ratios of monomers cholesterylacrylate and 1-hexene in liquid crystalline co-polymers: their synthesis and characterization*, Journal of Polymer Materials. **28**(1), 49.

7. Devasish Chowdhury (2011): *Magnetic Field induced assembly of polyvinylpyrrolidone stabilized cobalt ferrite nanoparticles in different dispersion medium.*, Journal of Exp. Nanoscience (in press, doi. 10.1080/17458080.2010.501459).

8. A. J. Choudhury, S. A. Barve, Joyanti Chutia, A. R. Pal, D. Chowdhury, R. Kishore, Jagannath, N. Mithal, M. Pandey and D.S. Patil (2011) : *Investigations of the hydrophobic and scratch resistance behavior of polystyrene films deposited on bell metal using RF-PACVD process*, Applied Surface Science. **257**, 4211.

9. A. J. Choudhury, J. Chutia, S. A. Barve, H. Kakati, A. R. Pal, J. N. Mithal and D. S. Patil (2011) : *Studies of physical and chemical properties of styrene-based plasma polymer films deposited by radiofrequency Ar/styrene glow discharge*, Progress in Organic Coatings. **70**, 75.

10. Sankar Moni Borah, Arup Ratan Pal, Heremba Bailung, and Joyanti Chutia (2011) : *Effect of E × B electron drift and plasma discharge in dc magnetron sputtering plasma*, Chinese Physics B. **20** (1), 014701.

11. A. Pator, J. Kotoky, D.C. Baruah, T. Mudoi, K.K. Sharma, D. Devi and R.Devi (2011) : *Hypolipidemic and Antiatherosclorotic effect of dried pulp of Garcinia Morella L fruit in Cholesterol fed mice.* Asian Jr. Expl. Biological Science, **2(2)**, 237.

12. Dipali. Devi, Neelotpal Sen Sarma, Bijit Talukdar, Prafulla Chetri, K.C. Baruah and Narendra Nath Dass (2011): *Study of the structure of degummed Antheraea assamensis (Muga) silk fiber.* The Journal of the Textile Institute. 17, iFirst Article, DOI:10.1080/00405000.2010.498172.

13. K. C. Baruah, Dipali. Devi, B. Talukdar and S. S. Majaw (2010): *Exploration of physical properties and FT- IR spectra for characterization of natural silk with special reference to Muga silk.* Journal of the Indian Academy of Forensic Sciences. **42(1&2)**, 69.

14. R. Devi, D. C. Boruah, D. K. Sharma and J. Kotoky (2011): *Leaf extract of Clerodendron colebrookianum inhibits intrinsic hypercholesterolemia and extrinsic lipid peroxidation.* **International J of Pharm Tech Research, 3(2), 962.**

15. Vladmir Pesic, Tapas Chatterjee and Sabitry Bordoloi (2010): *A Checklist of watermites (Acari: Hydrachnidia) of India, with new records and description of one new species.* Zootaxa 2617, 1.

16. A. K. Talukdar, S. Deka and Abul Hussain (2010): *Evalution of Water Quality Index at Goalpara Town and its surrounding Areas in Assam, India.* Nature Environment and Pollution Technology. **9 (3)**, 615.

17. Paramita Chakravarty, Sabitry Bordoloi, Stéphane Grosjean, Annemarie Ohler & Aparajita Borkotoki (2011): *Tadpole morphology and table of developmental stages of Polypedates teraiensis (Dubois, 1987).* Alytes, **27(3)**, 85.

18. U. J. Medhi, A. K. Talukdar and S. Deka (2011): *Impact of paper mill effluent on growth and development of certain agricultural crops.* J. Env. Biol. **32**, 185.

19. G.Choudhury, L.Tadj and K. Deka (2010): *A batch arrival retrial queueing system with phases of service and service interruption*, Comput. Math. Appl., **59**, 437.

20. M. Choudhury, Lipi B. Mahanta, J. Goswami, M. Mazumder, B. Pegoo (2011) : *Socio-economic profile and Food safety knowledge and practice of Street Food Vendors in the city of Guwahati, Assam*, Food Control., **22(2)**, 196.

21. B.C. Tripathy and H. Dutta (2010): *On some new paranormed difference sequence spaces defined by Orlicz functions*, Kyungpook Math. Jour., **50(1)**, 59.

22. B.C. Tripathy and A. Baruah (2010): *Lacunary statistically convergent and lacunary strongly convergent generalized difference sequences of fuzzy real numbers*, Kyungpook Math. Jour., **50(4)**, 565.

23. B.C. Tripathy and A. Baruah (2010): *Nörlund and Riesz mean of sequences of fuzzy real numbers*, Appl. Math. Letter, **23**, 651.

24. B.C. Tripathy and S. Mahanta (2010): *On I-acceleration convergence of sequences,* Jour. Franklin Inst., 347, 591.

25. G.C. Das, B. Choudhury and M.P. Bora (2010) : *Evolution of Ion-Acoustic Solitary Waves in Maxwellian Plasmas*, Phys. Plasmas, 17, 123707.

26. G.C. Das and K. Devi (2010) : *Evolution of Double Layers In Magnetized Plasmas Contaminated With Dust Charge Fluctuations*, Astrophys Space Sci. **330**, 799.

27. G.C. Das and R. Chakraborty (2011) : *Study On Sheath Formation In Astroplasmas Under Coriolis Force And Behavior Of Levitated Dust Grains Forming Nebulon Around Moon*, Astrophys Space Sci. 332 (2), 301.

28. Manisha Choudhury, Lipi B. Mahanta, Jayashree Sarmah Goswami and Meenakshi Dutta Mazumder (2011): *Will Capacity Building Training Interventions given to street food vendors give us safer food? : A cross-sectional study from India*, Food Control. (In Press)

29. S.M. Borah, H.Bailung, J. Chutia (2010): *Decorative Titanium Nitride Colored Coating on bell-metal by Reactive cylindrical Magnetron sputtering.* Prog. Color Colorants Coat, 3, 74.

7.2 In Conferences

1. **Devasish Chowdhury** (2011): *"Ni coated polyaniline nanowire as chemical sensor"* presented in the National seminar on current trends in polymer science and technology (Poly-2011) held at Jadavpur University. Kolkata during January 28-29, 2011.

2. Devasish Chowdhury and John A. Rogers (2010): *"Single walled carbon nanotube based chemoresistor for the detection of Arsenic (V)"* presented in **Frontiers in Chemical Sciences (FICS) 2010** held at Department of Chemistry, Indian Institute of Technology Guwahati during December 3-4, 2010.

3. Lakshinandan Goswami and Devasish Chowdhury (2010): *"Passivation of CdS nanocrystals by bifunctional molecules"* presented in **Frontiers in Chemical Sciences (FICS) 2010** held at Department of Chemistry, Indian Institute of Technology Guwahati during December 3-4, 2010.

4. Samiul Hoque, Narendra Nath Dass and Neelotpal Sen Sarma, (2011): *"Synthesis and characterization of liquid crystalline polycholesterylmethacrylate and polycholesterylmethacrylate co 1-hexene"*, presented in the **National Seminar on Current Trends in Polymer Science and Technology,** held at Jadavpur University, Kolkata during January 28-29, 2011.

5. Porimita Saikia, Samiul Hoque, Narendra Nath Dass and Neelotpal Sen Sarma, (2011): *"Popcorn polymerization of glyceryl 10-undecylenate, a novel monomer"*, presented in the **National Seminar on Current Trends in Polymer Science and Technology,** held at Jadavpur University, Kolkata during January 28-29, 2011.

6. Samiul Hoque, Narendra Nath Dass and Neelotpal Sen Sarma, (2011): *"Liquid crystalline polymer of cholesteryl acrylate and cholesteryl methacrylate and copolymers with 1-hexene"* presented in the **56 Annual Technical Session of Assam Science Society** held at Dibrugarh University, Dibrugarh on March 26, 2011.

7. Porimita Saikia, Samiul Hoque, Narendra Nath Dass and Neelotpal Sen Sarma, (2011): *"Encapsulation of glyceryl 10-undecylenate in filter paper"* presented in the **56 Annual Technical Session of Assam Science Society** held at Dibrugarh University, Dibrugarh on March 26, 2011.

8. A. J. Choudhury, Joyanti Chutia and D.S. Patil, (2010): *"Radiofrequency plasma deposition from Ar/HMDSO/O_2 glow discharge: Correlation between chemical structure and thin film mechanical and thermal properties"*, presented in **63rd Annual Gaseous Electronics Conference and 7th International Conference on Reactive Plasmas,** held at *Maison de la Chimie,* Paris, France during October 4 - 8, 2010.

9. D. Gogoi, A. J. Choudhury, Joyanti Chutia A. R. Pal, (2010): *"Radiofrequency Ar plasma treatment for improvement of wettability and mechanical strength of muga silk fiber"*, presented in the **National Symposium on Plasma Science and Technology (PLASMA-2010),** held at IASST, Guwahati during December 8-11, 2010.

10. A. J. Choudhury, Dolly Gogoi, Joyanti Chutia, A. R. Pal, D. Devi, D. S. Patil, (2011): *"Studies of tensile strength and hydrophobicity of muga silk fiber (aantheraea asamenisis) using radiofrequency Ar plasma treatment: Effect of discharge parameters"* presented in the **National Workshop on Nuclear and Atomic Technique based Pure and Applied Sciences,** held at Tezpur University, Assam during February 1-3, 2011.

11. N. C. Adhikary, Y. Nakamura and O. Ishihara, (2010): *"Determination of ion temperature from rotating dust cluster in the presence of magnetic field in a plasma"*, presented in the **11th Workshop on Fine Particle Plasmas,** held at the National Institute of Fusion Sciences, Toki, Japan during November 19-20, 2010.

12. M. Chikasue, N. C. Adhikary, N. Uotani, C. Sekino, M. Shindo and O. Ishihara, (2010): *"Study of thermophoretic force on a dust particle in collisional cryogenic plasma"*, presented in the **11th Workshok on Fine Particle Plasmas**, held at the National Institute of Fusion Sciences, Toki, Japan during November 19-20, 2010.

13. Joyanti Chutia, Arup R Pal and Bimal K Sarma, (2010): *"TiO_2/Polyaniline nanocomposite films prepared by modified plasma polymerization process"*, presented in **63rd Annual Gaseous Electronics Conference and 7th International Conference on Reactive Plasmas,** held at *Maison de la Chimie,* Paris, France during October 4 - 8, 2010.

14. Bimal K Sarma, Arup R. Pal, H. Bailung and Joyanti Chutia, (2010): *"Crystallinity Control of TiO_2 Films By Low RF Substrate Bias in Reactive Magnetron Plasma Process"*, presented in the **National Symposium on Plasma Science and Technology (PLASMA-2010),** held at IASST, Guwahati during December 8-11, 2010.

15. Shyamalima Sharma, A. R. Pal, Joyanti Chutia, H. Bailung, N. S. Sarma and D. S. Patil, (2010): *"Optimization of Plasma Control Variables For Synthesis of Photo-Absorbing Plasma Polymerized Aniline Thin Films Suitable For Organic Solar Cell"*, presented in the **National Symposium on Plasma Science and Technology (PLASMA-2010),** held at IASST, Guwahati during December 8-11, 2010.

16. Manoj Kumar Deka and Heremba Bailung, (2010): *"Role of electron energy distribution on dust charging processes"*, presented in the **National Symposium on Plasma Science and Technology (PLASMA-2010),** held at IASST, Guwahati during December 8-11, 2010.

17. Sumita K. Sharma, H. Bailung and Y. Nakamura, (2010): *"Ion beam interaction with ion acoustic rarefactive soliton in multicomponent plasma"*, presented in the **National Symposium on Plasma Science and Technology (PLASMA-2010),** held at IASST, Guwahati during December 8-11, 2010.

18. Y. Nakamura, S. K. Sharma, N. K. Bhagobaty and H. Bailung, (2010): *"Excitation of transverse waves in a two dimensional monolayer plasma crystal"*, presented in the **National Symposium on Plasma Science and Technology (PLASMA-2010),** held at IASST, Guwahati during December 8-11, 2010.

19. Kaustav K Sharma, R Saikia, J Kotoky, J C Kalita, D C Baruah, T Mudoi, J K Das, R and J Das (2011) *"Evaluation of in vitro and in vivo anti dermatophytic activity of four medicinal plants of Assam"* presented in the **National Conference on Emerging Trends in Natural Product Research** at School of Natural Products studies held at Jadavpur University, Kolkata during February 12-13, 2011.

20. Kaustav K Sharma, R Saikia, J Kotoky, J C Kalita, D C Baruah, T Mudoi, J K Das, R Devi and J Das (2011) *"Study of some Medicinal Plant of Assam used against Antifungal Activities"* presented in the **National Conference on in the 15th International conference under Indian society of Chemists and Biologists (ISCB)** , on the subject- "Bridging Gaps in Discovery and

Development: Chemical and Biological Sciences for Affordable Health, Wellness and Sustainability" organized by Saurastra University during February 4 - 7, 2011.

21. Kaustav K Sharma, R Saikia, J Kotoky, J C Kalita, D C Baruah, T Mudoi, J K Das, R Devi and J Das (2011) *"Antifungal properties of Medicinal Plants of N.E Region"* presented in the "Ramanbhai Foundation **5th International Symposium on "Advances in Translational Research and Medicine"** organized by Zydus Researc Foundation during February 1 - 4, 2011

22. Rajlakshmi Devi, Tiluttama Mudoi, Dibakor C Deka and Dulal C Baruah (2010): *"Antiperoxidative effect of Musa balbisiana fruit an indigenous plaintain of N E region of India" presented in the* **43rd Annual Conference of Indian Pharmacological Society & International Conference** held at National Institute of Nutrition, Hyderabad during December 13 - 16, 2010.

23. Tiluttama Mudoi, Dibakor C Deka and Rajlakshmi Devi (2011) *"Antiperoxidative and antioxidant effect of the juice of Citrus grandis fruit in cholesterol fed rats"* presented in the **National Conference on emerging Trends in Natural product Research** at school of natural products studies held at Jadavpur University, Kolkata during February 12-13, 2011.

24. Dipali Devi, Arundhuti Choudhury, Saranga Dutta and Ramesh Nath, (2010): *Studies On Apolipophorin III level during Pseudomonas aeruginosa pathogenesis in Antheraea assamensis Helfer,* presented in the **6th International Conference on Wild Silkmoth** held at Department of Applied Biology and Chemistry, Tokyo University of Agriculture, Tokyo, Japan during September 21 - 24, 2010.

25. Chatoan Tesia and Sabitry Bordoloi(2010): *"A Study on Amphibian Diversity of Charju river system, Tirap District, Arunachal Pradesh, India"* presented in the **National Seminar on "Biodiversity, Ecosystems and Climate Change: The Challenge Ahead "** Organized by National Institute of Ecology at Lucknow during September 25 27, 2010.

26. Sabitry Bordoloi, Budhadev Basumatary, Rubul Saikia and Hamendra Chandra Das (2010): *"Two Potential herb species for phytoremediation of hydrocarbon contaminated soil in Oil field areas of Assam (India)"* presented in **Seventh International Phytotechnologies Conference 2010** held at Parma, Italy, during September 26 29, 2010.

27. Budhadev Basumatary, Rubul Saikia and Sabitry Bordoloi (2011): *"A study on native plant species for phytoremediation of petroleum hydrocarbon contaminated soil"* in a UGC sponsored **National Seminar on "Plant Resource Management and Conservation Strategies in N.E. Region"** organized by Department of Botany, Cotton College, Guwahati, during February 18 -19, 2011.

28. H. Deka, S. Deka, C. K. Baruah, J. Das and R. R. Saikia (2011): *"Vermicompost assisted phytoremediation for removal of hydrocarbons from contaminated soil" presented in the* **National Seminar on 'Plant resource management and conservation strategies in N. E. region'** held at Cotton College, Guwahati, Assam, India during February 18-19, 2011.

29. R. R. Saikia, S. Deka, M. Deka and H. Deka (2011): *"Isolation of potential biosurfactant producing strain from contaminated soil for bioremediation study" presented in the* National **Seminar on 'Plant resource management and conservation strategies in N. E. region'** held at Cotton College, Guwahati, Assam, India during February 18-19, 2011.

30. R. R. Saikia, S. Deka and M. Deka (2011): *"Factors affecting production of biosurfactant by Pseudomonas aeruginosa RS29"* presented in the **56th Annual Technical Session of Assam Science Society** held at Dibrugarh University on March 26, 2011.

31. B.C. Tripathy and S. Borgohain (2010) : *"On a class of generalized difference sequence spaces related to space defined modulus function",* **Proceedings of International Conference on Rough Sets, Fuzzy Sets and Soft Computing,** held during November 5-7, 2009, organized by Department of Mathematics, Tripura

University, Serials Publications, 409-417.

32. Rupa Chakraborty and G. C. Das (2010): *"Formation of Dust Cloud in Rotating Magnetized Astroplasmas"* presented in **25th National Symposium on Plasma Science & Technology,** Guwahati, December 8-11, 2010.

33. Rupa Chakraborty and G.C. Das (2011): *"Evolution of Nonlinear Waves in Space under the Influence of Rotation"* presented at **First National Conference on Applied Mathematical Sciences [1st NACMS-2011]** held at Sikkim Manipal Institute of Technology (SMIT), during March 11-13, 2011.

34. Karabi Das and G. C. Das (2011): *"Nonlinear Ion Acoustic Solitary Wave In Ion Beam Plasma Embedded by a Magnetic Field"* presented at the **First National Conference on Applied Mathematical Sciences [1st NACMS-2011]** held at Sikkim Manipal Institute of Technology (SMIT), during March 11-13, 2011.

35. Balen Choudhury, M. P. Bora and G.C. Das (2011): *"Study on Nonlinear Burger Wave Equation in Maxwellian Dusty Plasmas"* presented at the **First National Conference on Applied Mathematical Sciences [1st NACMS-2011]** held at Sikkim Manipal Institute of Technology (SMIT), during March 11-13, 2011.

36. B. C. Tripathy (2011): "On Ideal Convergence of Sequences", presented in the **"International Conference on Mathematics of Dates"** organized by Pushpa publishing house held at Allahabad during 31st Dec. 2010- 4th Jan. 2011.

37. Amar Jyoti Dutta, B.C. Tripathy.(2011): *"Fine Spectra of the Difference Operator over the Sequence Space"*, presented in the **"International Conference on Mathematics of Dates"** organized by Pushpa publishing house held at Allahabad during 31st Dec. 2010- 4th Jan. 2011.

38. Stuti Borgohain, B.C. Tripathy. (2011): *"On a Class of n-normed Sequence Space Related to - space", presented* in the **"International Conference on Mathematics of Dates"** organized by Pushpa publishing house held at Allahabad during 31st Dec. 2010- 4th Jan. 2011.

7.3 Book / Book Chapters

1. Edited by Sabitry Choudhury Bordoloi, Lingaraj Sahoo, Balwant Singh (2010) : Proceedings of the workshop *"Development & Optimization of Combined Plant/ Microbe Technologies for Bioremediation of Soil Contaminated with hydrocarbon and Heavy Metals"* held at Guwahati on 29th and 30th October 2008. (ISBN: 978-81-8465-668-8)

2. Joyanti Chutia, (2010): Assamese translation of the Book "Hundred Reasons to be a Scientist" published by ICTP, Trieste, Italy.

3. Sumita Kumari Sharma and D. K. Choudhury (2010): "Pentaquarks and Glueballs: Basics, Models, Experiments", Lambert Academic Publishing, Germany ISBN: 978-3-8383-9984-3.

7.4 Patents

1. *"Radiofrequency plasma polymerization technology for surface protection of bell metal at low temperature"*, J. Chutia, D. S. Patil, A. J. Choudhury and A. R. Pal, Indian patent application No. 1313/KOL/2010.

Instrumentation Facilities at IASST

X-Ray Diffraction (XRD)

Diffrential Scanning Calorimeter (DSC)

Thermogravimetric Analysis (TGA)

Milipore Water Purification System

Gel permeation chromatography (GPC)

Fourier Transform infrared spectrometer (FTIR)

Instrumentation Facilities at IASST

Atomic Adsorption Spectrometer (AAS)

Optical Emission Spectrometer

Plasma set up

UV-vis Spectrometer

Phase contrast microscope

Tensiometer

8. MSc. / B. Tech Projects

1. Ms. Ankita Hazarika, M Sc Student , VIT, Channai is doing her M Sc dissertation entitled *"Evaluation of antiperoxidative and hypolipidemic effect of a herbal formulation used by the rural people of Northeast India"* under supervision of Dr Rajlakshmi Devi.

2. Ms. Meenakshi, Boston College, Bangalore is doing her M Sc dissertation entitled *"Study of the antifungal and antioxidant activity of two citrus fruits of northeast India"* under the supervision of Dr Rajlakshmi Devi

3. Momita Das, a student of M. Sc. (biotechnology) from Dolphin (PG) Institute of Biomedical and Natural Science, Dehradun has been doing her dissertation work in the topic *"Study of Impact of Pollution with special reference to PAHs on soil/water and certain medicinal plants in some polluted sites of Guwahati city"* under the guidance of Dr. Jibon Kotoky.

4. Ms. Diptika Tiwari, 4th semester M. Sc. student of Department of Biotechnology, Gauhati University, Guwahati did her project *"Isolation of hydrocarbon degrading bacteria from contaminated soil"* under the guidance of Dr. Suresh Deka.

5. Ms. Karabi Saikia, 4th semester M. Sc. student of Department of Biotechnology, Gauhati University, Guwahati did her project *"Evaluation of Biosurfactant producing bacterial strains isolated from hydrocarbon contaminated soil"* under the guidance of Dr. Suresh Deka.

6. Mr. Chinmoy Pathak, 5th semester B.Tech. Student of Department of Biotechnology, Amity University, Noida, UP did her project titled *"Production of Biosurfactant by Pseudomonas aeruginosa and study of its antimicrobial activity"* under the guidance of Dr. Suresh Deka.

7. Mr. Bijuphukan Bhagabati of BITS, Pilani did his M.S in Software System dissertation titled *"Development of certain Digital Watermarking techniques for security enhancement of document images"* under the guidance of Mr. Anupam Barman.

9. Conferences / Workshop / Exhibition attended

1. Dr. Devasish Chowdhury and Mr. Lakshinandan Goswami have attended the National conference on *Frontiers in Chemical Sciences (FICS)* 2010 held at Department of Chemistry, Indian Institute of Technology Guwahati during December 3-4, 2010.

2. Dr Neelotpal Sen Sarma, Dr. Devasish Chowdhury, Mr. Samiul Hoque and Ms. Porimita Saikia have attended the *National Seminar on Current Trends in Polymer Science and Technology (POLY- 2011)* held at Jadavpur University, Kolkata during January 28-29, 2011.

3. Mr. Samiul Hoque and Ms. Porimita Saikia have attended the *56th Annual Technical Session of Assam Science Society* held at Dibrugarh University, Dibrugarh on March 26, 2011.

4. Prof. Joyanti Chutia and Mr. Arup Jyoti Choudhury attended the *63rd Gaseous Electronics Conference and 7th International Conference on Reactive Plasmas* held at Maison de la Chimie, Paris, France during October 4 - 8, 2010.

5. Mr. Manoj Kr. Deka, Ms. Sumita Kumari Sarmah, Ms. Dolly Gogoi, Ms. Shyamalima Sharma, Mr. Ranjan Kalita, Mr. Amarjyoti Kalita, Mr. Tapan Barman and Mr. Bhahesh Kumar Nath have participated in the *DST-SERC School on Plasma Waves and Instabilities* held at IASST, Guwahati during February 7-21, 2011.

6. Mr. Manoj Kr. Deka, Ms. Sumita Kumari Sarmah, Ms. Dolly Gogoi, Ms. Shyamalima Sharma and Mr. Bimal Kumar Sarma have attended the *National Symposium on Plasma Science and Technology, PLASMA-2010* held at IASST, Guwahati during December 8-11, 2011.

7. Dr. Nirab Chandra Adhikary has attended the *11th Workshop on Fine Particle Plasmas held at* National Institute of Fusion Science (NIFS), Toki, Japan during November 19-20, 2010.

8. Ms. Dolly Gogoi has attended the *Workshop on Scanning Electron Microscope held at* North-Eastern Hill University, Shillong during March 1-4, 2011.

8. Ms. Rupa Chakraborty attended the *25th National Symposium on Plasma Science & Technology* held at IASST, Guwahati during December 8-11, 2010.

10. Ms. Rupa Chakraborty, Ms Karabi Das and Mr. Balen Choudhury attended the *First National Conference on Applied Mathematical Sciences (1st NACMS-2011)* held at Sikkim Manipal Institute of Technology (SMIT) during March 11-13, 2011.

11. Dr. Jibon Kotoky and Jitendra Kumar Das participated in the *15th International conference under Indian society of Chemists and Biologists ISCB),* on the subject- "Bridging Gaps in Discovery and Development: Chemical and Biological Sciences for Affordable Health, Wellness and Sustainability" organized by Saurastra University from February 4 - 7, 2011.

12. Dr. Jibon Kotoky and Jitendra Kumar Das participated in the Ramanbhai Foundation *5th International Symposium* on "Advances in Translational Research and Medicine" organized by Zydus Research Foundation, M/S. Zydus-Cadila, Ahmedabad during February 1-4, 2011.

13. Dr. Jibon Kotoky and Kaustav K. Sharma participated in the *National seminar on Emerging Trends in Natural Product Research* at School of Natural Products studies held at Jadavpur University, Kolkata during February 12-13, 2011.

14. Dr. D. Devi attended a workshop on *Recent Advances in Sericulture Research* held at Bengaluru during May 18- 19, 2010 sponsored by Centre for DNA Figerprinting and Diagnostics, Hyderabad and Central Silk Board, Bengaluru.

15. Mr. Bijit Talukdar and Mr. Saranga Dutta participated in the *National Seminar on 'Seri-biodiversity of North East India and its Conservation and Prospects,* sponsored by UGC, organized by Department of Zoology, Dhing College, Dhing during January 28-29, 2011.

16. Dr. Rajlakshmi Devi attended the Brainstorming workshop on *Traditional Fermented Food of NE India* held at IBSD, Imphal during September 2-3, 2010.

17. Dr. S. Deka attended the *National seminar on bioresources, habitat threats conservation strategies and sustainable development* held at Hojai College, Nagaon, Assam, India during November 10-11, 2010.

18. Dr. S. Deka attended the *National seminar on plant resource management and conservation strategies in N. E. region* held at Cotton College, Guwahati, Assam, India during February 18-19, 2011.

20. Rashmi Rekha Saikia participated in the Workshop on *Basic Statistics and its Computer Applications (SPSS)* held in the Department of Statistics, Gauhati University during September 27 to October 01, 2010.

21. Sabitry Choudhury Bordoloi and Budhadev Basumatary attended *Seventh International Phytotechnologies conference* organized at Parma, Italy during September 26 29, 2010.

22. Sabitry Choudhury Bordoloi attended the workshop on *Western Ghats Network of Protected Areas for Threatened Amphibians (WNPATA)* organized by Delhi University during November 2-3, 2010

23. Mrinal Kumar Das attended the *National Symposium on "Biodiversity of Assam: Status, Development and Conservation"* Organized by Assam Science Society during December 4 5, 2010.

24. Sabitry Choudhury Bordoloi attended the workshop on *Sensitization Training for establishment of National Agricultural Bioinformatics Grid* in ICAR organized by NBFGR, Lucknow during Januray 24 28, 2011.

25. Chatoan Tesia attended *4th School in Herpetology" at Sálim Ali Centre for Ornithology and Natural History* held at Coimbatore, Tamil Nadu, India during January 24, 2011 to February 7, 2011.

26. Chatoan Tesia attended workshop on *Basic Principles, Preparatory Methods and Biological Applications in Transmission Electron Microscopy* at sophisticated analytical instrument facility, North-Eastern Hill University, Shillong during March 22 25, 2011.

27. Dr (Mrs) Arundhuti Devi attended the Workshop on *Small area estimation : Theory and application in health sciences* held at Gauhati University during March, 10 -12, 2011.

28. Dr. B. C. Tripathy, Dr. Amar Jyoti Dutta and Ms Stuti Borgohain participated in the *International Conference on Mathematics of Dates* organized by Pushpa publishing house held at Allahabad during December 31, 2010 to January 04, 2011.

29. Dr. B. C. Tripathy participated in the Workshop on *Results-Framework Document (RFD), An Instrument for Improving Government Performance* organized by Cabinet Secretariat Performance Management Division held at Vigyan Bhawan, New Delhi on February 22, 2011.

30. Dr. Lipi B. Mahanta and Ms. N. Rajbongshi attended the North-East Region Workshop on *Small Area Estimation: Theory & Applications in Health Sciences* organized jointly by Indian Statistical Institute (Applied Statistics Division) & Department of Statistics, Gauhati University at Department of Statistics, Gauhati University, during March 10-12, 2011.

31. Mr. T.D.Goswami attended the DST Nodal Officers /Librarians' meeting on *"National Knowledge Resource Consortium"*, jointly organized by coordinator, NKRC and Library, JNCASR held at JNCASR, Bangalore during May 10-12, 2010.

32. Mr. T.D.Goswami attended the seminar on *Legislation based Library in N.E. India with special reference to Assam*, jointly organized by Assam Library Association, Guwahai, Assam and Raja Rammohan Ray Library Foundation, Kolkata, West Bengal held at Guwahati on December 30, 2010.

33. Mr. Anupam Barman attended the workshop on *National Knowledge Network (NKN)* at Delhi University on 25th March 2011.

10. Ph. D Awarded

1. Mr. Nirab Chandra Adhikary was awarded Ph.D degree by Gauhati University for his thesis *"Studies on ion acoustic wave interaction in laboratory dusty plasma system"* under the supervision of Dr. H. Bailung and Prof. Joyanti Chutia in 2010.

2. Mr Ramesh Nath was awarded Ph.D degree by Gauhati University for his thesis *"Taxonomical traits of Semi domesticated stock and wild counterpart of Antheraea assamensis Helfer in North East India"* under the supervision of Dr. Dipali Devi in 2010.

3. Ms. Paramita Chakravarty was awarded Ph.D degree by Gauhati University for her thesis *"Taxonomic study of some anuran tadpoles of Assam with special reference to the development of Polypedates leucomystax (Gravenhorst,1829)"* under the supervision of Dr. Sabitry.Bordoloi and Prof. Aparajita Borkotoki in 2010.

4. Ms Banita Ningobam was awarded Ph.D degree by Gauhati University for her thesis *"Amphibian fauna in and around Loktak lake, Manipur, India with special reference to the genus Amolops (Gunther)"* under the supervision of Dr.Sabitry Choudhury Bordoloi in 2010.

5. Mr. Hemen Deka was awarded Ph.D. degree by Gauhati University for his thesis entitled *"A study on Utilization of Bio-wastes for production of Vermicompost"* under the supervision of Dr. Suresh Deka and Prof. C. K. Baruah in 2010.

6. Mr. Achyutananda Baruah was awarded Ph.D. degree by Gauhati University for his thesis *"Some Difference Sequence of Fuzzy Real Numbers and Norlund and Riesz Mean"* under the supervision of Dr. Binod Chandra Tripathy in 2010.

11. Awards and Recognition

1. Dr. Sabitry Choudhury. Bordoloi was selected as a FELLOW of National Institute of Ecology (NIE), Delhi on 21st May, 2010.

12. Lectures delivered on invitation

1. Prof. Joyanti Chutia, Director, IASST delivered an invited talk entitled *"TiO / Polyaniline nano-composite Films prepared by modified Plasma polymerization"* in *63rd Gaseous Electronics Conference and 7th International Conference on Reactive Plasmas* held at Maison de la Chimie, Paris, France during October 4 - 8, 2010.

2. Dr. H. Bailung has delivered 3 lectures in the *DST SERC School on Plasma Waves and Instabilities* held at IASST, Guwahati in December 2010.

3. Dr. Jibon Kotoky delivered an Invited talk on *"Drug, Discovery, Development and Marketing: An Overview of a case study* in the National Seminar" sponsored by UGC, New Delhi, organized by the Pharmaceutical Sciences, Dibrugarh University from Feb. 24-25, 2011.

4. Dr. Jibon Kotoky delivered an Invited talk in the *National Seminar on Chemistry and Medicinal Plants"* sponsored by UGC, New Delhi, organized by Chemistry Dept. Manipur University, Imphal from March. 9-10, 2011.

5. Dr. Dipali Devi delivered an invited lecture in the *National Symposium on Biodiversity of Assam, Status, Development and Conservation* organized by the Assam Science Society held on December 4-5, 2010.

6. Dr. Dipali Devi delivered an invited talk on sericulture biodiversity and livelihood at *National Seminar on 'Seri- biodiversity of North East India and its Conservation and Prospects,* sponsored by UGC, organized by Department of Zoology, Dhing College, Dhing during January, 28 - 29, 2011.

7. Dr. Sabitry Bordoloi presented a paper entitled *"Two Potential herb species* for phytoremediation of hydrocarbon contaminated soil in Oil field areas of Assam (India)" by Sabitry Bordoloi, Budhadev Basumatary, Rubul Saikia and Hamendra Chandra Das in Seventh International Phytotechnologies Conference held at Parma, Italy, during 26 - 29 September, 2010.

8. Dr. Sabitry Bordoloi (2010): delivered a presentation on" *Study on Biodiversity of four states of North eastern Region of India"* presented in the *National Symposium on "Biodiversity of Assam: Status, Development and Conservation"* Organized by Assam Science Society, 4 - 5 December, 2010.

9. Dr. S. Bordoloi delivered a talk *"Open dumping of MSW at Boragaon"* in Scientific Seminar on Deepor Beel held at NEDFI Auditorium, Dispur, Assam on 19th December,2010 organised by Rotary club of Guwahati

10. Dr. B. C. Tripathy delivered a talk in the *"International Conference on Mathematics of Dates"* organized by Pushpa publishing house held at Allahabad during 31st Dec. 2010- 4th Jan. 2011 titled "On Ideal Convergence of Sequences".

13. Other Activities

1. Pre-Ph.D course work: Classes on plasma physics have been taken for six months duration for the students of Gauhati University who are registered for Ph.D program with specialization in Plasma Physics.

2. Training of M. Sc. students: M.Sc. students of Gauhati University have been imparted training of 15 days duration on basic experiments on plasma physics.

3. Dr. Dipali Devi was the Chairperson for the 4th Technical Session on National Seminar on "Seri-biodiversity of North East India and its Conservation and Prospects", sponsored by UGC, organized by Department of Zoology, Dhing College, Dhing during 28th and 29th January, 2011.

4. Rajlakshmi Devi participated in the Hands on Training on Techniques used in "Biotechnological Research" held at NEHU, Shillong from Feb 28- to March 12, 2011.

5. Dr. B.C. Tripathy is a Nomination Council member of the INFOSYS PRIZE 2011, for *Mathematical Sciences*.

6. Dr. B.C. Tripathy is an Editorial Board member of the periodical "*Journal of Advanced Research in Pure Mathematics*" USA, "*Journal of Advanced Research in Fuzzy and Uncertain Systems*" USA, "*Journal of Analysis and Applications*", "*Turkish Journal of Science and Technology*", "*Far East Journal of Mathematical Sciences*" (Pushpa Publishing House), Allahabad periodical "*Journal of Indian Academy of Mathematics*" Indore, "*Advances in Mathematical Sciences Journal*", Allahabad, "*Global Journal of Applied Mathematics and Mathematical Sciences*", New Delhi.

7. Dr. B.C. Tripathy Chaired one session in the International Conference on Mathematics of Dates organized by Pushpa publishing house held at Allahabad during 31st Dec. 2010- 4th Jan. 2011.

8. Dr. G. Choudhury is the Editorial Board member of "Far East Journal of Theoretical Statistics" (Pushpa Publishing House), Allahabad.

9. Dr. G. Choudhury a Guest Editor of "Quality Technology and Quantitative Management" for the Special issue "Management Policies of Queueing Control"(Vol.-8,(3), 2011) FCU Press, Taiwan.

10. Dr. B.C. Tripathy was an organising Committee member of the National Conference on "Recent Trends in Mathematical Analysis and Applications" organized by the Department of Mathematics, Berhampur University, Berhampur, Orissa held during December 22-23, 2010 and National Conference on "Recent Advances in Mathematics and its Applications" organized by the Department of Mathematics, Brahmanand College, Kanpur held on February 12, 2011.

11. Dr. Neelotpal Sen Sarma was an National Advisory Committee member of the UGC-Sponsored National Seminar on "Polymer Science and Technology: Vision and Scenario" in collaboration with Biswanath College, B.Chariali held on February, 11- 12, 2011

12. Dr. B.C. Tripathy is a member of the American Mathematical Society, U.S.A.

13. Dr. B.C. Tripathy is appointed as a Reviewer for "Mathematical Reviews" of American Mathematical Society, U.S.A. and "Zentralblatt Math", Germany.

14. Dr. G. Choudhury is appointed as a Reviewer for "Mathematical Reviews", American Mathematical Society, U.S.A.

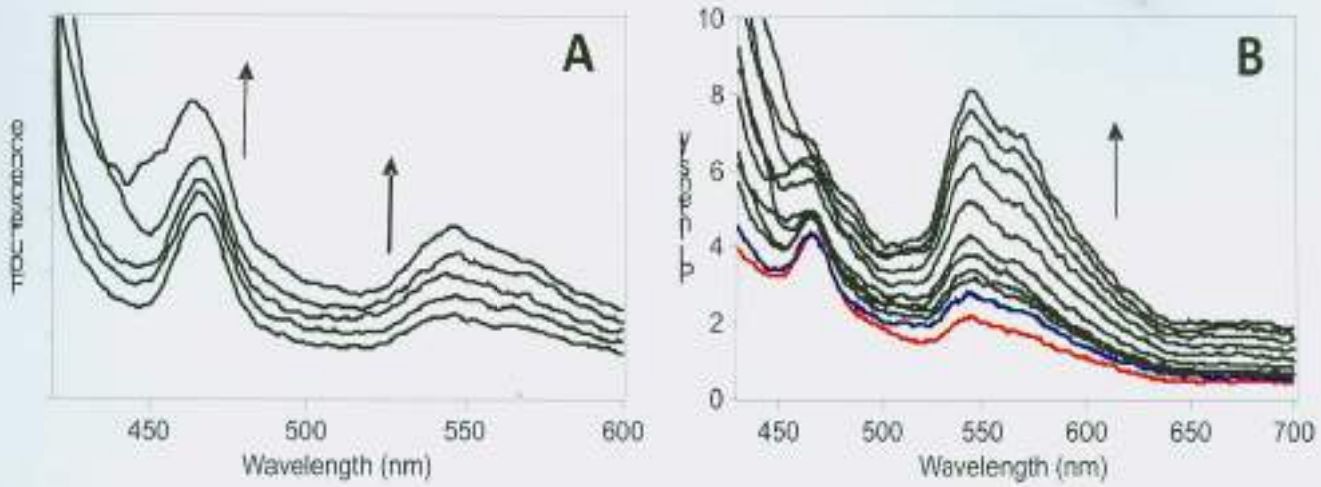


Figure 1.2.6. *Photoluminescence spectra of CdS after systematic addition of* (A) *MUA* and (B) *Ag nanoparticles to MUA capped CdS Ncs.*

Figure 1.2.5 (A) shows the UV-vis spectra of CdS nanocrystals with systematic addition of mercaptoundecanoic acid (MUA). It is clear from the spectra that the absorption decreases and there is slight red shift in the excitonic peak as well as the onset value with the addition of MUA indicating the change in optical property of the CdS nanocrystals upon capping with MUA. The optical absorption curves were used to estimate the optical band gap (*Eg) by Wang formula* and from these values the particle size was estimated. The band gap energy was determined to be 2.8eV with particle size ~ 6 nm. MUA is a bifuctional molecule having two different functional groups i.e S-H (thiol) and COOH (carboxylic). The thiol functionality in MUA will attached on the surface of CdS nanocrystals making a coating around the CdS nanocrystals. Ag nanoparticles can then anchor on the free COOH and form $COO^{-}Ag^{0}$. We study the changes in optical property after anchoring of Ag nanoparticles on MUA capped CdS nanocrystals. The Ag nanoparticles were prepared separately by reduction of $AgNO_3$ with tri-sodium citrate and added in regular interval to observe the change in optical property after anchoring of Ag nanoparticle. The change in absorbance of the MUA capped CdS nanoparticles after anchoring of Ag nanoparticles is shown in Fig. 1.2.5 (B). The addition of Ag nanoparticles results in further decrease in absorbance and slight red shift in the excitonic peak. Similar observation were obtained with ME and Cys capped CdS and after anchoring of Ag NPs.

Photoluminescence (PL) study was also performed on CdS nanocrystals with different bi-functionally capping agents and after anchoring of Ag NPs. The PL spectra of CdS after addition of MUA are shown in figure 1.2.6. The CdS nanocrystals show the band gap emission at ~464 nm and a broad trap state emission at ~ 546 nm (excitation at 405 nm). Addition of capping agent like MUA increases the photoluminescence intensity of both the peaks. The enhancement in luminescence in bi-functionally capped CdS nanocrystals can be attributed to impurity level assisted recombination in the presence of capping agent. This will result in reduction in decay time as a result of increased impurity state. This will further result in reduction in surface states as a result of surface passivation. Anchoring of Ag NPs to MUA capped CdS nanocrystal also results in increase of the emission peaks at 464 nm and 546 nm

Fourier transformed infrared (FTIR) spectroscopy studies

Fourier transformed infrared (FTIR) spectroscopy were carried out on uncapped CdS, bifunctionally capped CdS nanocrystals (MUA, ME and Cys capped CdS) and after anchoring of Ag NPs to MUA, ME and Cys capped CdS and all the spectra are stacked in Fig. 1.2.7 (a-g).

14. Seminar / Training / Lecture / Exhibition Organized

1. Dr. S. Mukherjee from FCIPT, Institute for Plasma Research (IPR), Ghandhinagar visited IASST and gave a talk titled "Plasma surface Engineering" on 7th April 2010.

2. Prof. Naresh Dadhich, Emeritus Professor & former director of IUCAA, Pune, Pune University gave a talk "Why Einstein" on 20th May 2010.

3. Prof. Sandeep Kumar, Raman Research Institute (RRI), Bangalore gave a talk "How can crystals be liquid" on 23rd September 2010.

4. Prof. Milan Sanyal, Director, Saha Institute of Nuclear Physics visited the institute and gave a talk entitled "Novel physical properties of nanoparticles" on 24th December 2010.

5. Intra Departmental seven Lecture seminars organised in the Life Science Division, which was delivered by the Research Scholars of the Division. Two best presentations by the students during the year was selected and awarded for encouragement.

6. Workshop organised on **'Plant-Diversity & Environment Education through Students of Assam'**, sponsored and catalyzed by NCSTC, Dept. of Sc. & Technology, Govt. of India from 31st March to 4th April 2011 at L. D. Higher Secondary School, Bihpuria, Lakhimpur Dist, Assam amongst the students of Assam. Total of fifty eight students and Science teachers participated from fourteen schools of the North bank of the river Brahmaputra. Participants were demonstrated /educated about the Diversity of Natural sources of this part of the country and importance of Environment and its conservation of by Experts coming from various Institutions of Assam. Participants were taken to field also to collect Medicinal plants and showed how to identify these. Participants were encouraged to develop Medicinal plant garden and seed bank for future use and preservation.

25th National Symposium on Plasma Science and Technology(PLASMA-2010):

The 25th National Symposium on Plasma Science & Technology (PLASMA-2010) was organized by the Institute of Advanced Study in Science and Technology, Guwahati in association with the Plasma Science Society of India (PSSI) during December 8-11, 2010 at SHILPGRAM, Guwahati. Like every year, the symposium is designed to provide a forum for young researchers in Plasma Science & Technology to interact with eminent plasma scientists from India and abroad and to present their work. The scope of the symposium includes frontline research in basic plasma physics as well as significant advances in plasma technology. Considering the involvement of the host institute in basic Plasma research, the focal theme has been selected as "Basic Plasma Physics".

The inauguration meeting on 8th December, was presided over by Prof. Joynati Chutia, Director IASST and Chairperson, Local Organizing Committee. At the beginning of the inauguration ceremony, the Local Organizing Committee offered warm felicitation to Prof. P. K Kaw, Director, Institute for Plasma Research and Chairman of the National Advisory Committee (PLASMA 2010). Prof. P. K. Barhai, Head Deptt. of Applied Physics BIT, Mesra and President, Plasma Science Society of India welcomed the participants in his speech as guest of honour. Prof. Dhiraj Bora, Deputy Director General, ITER, France inaugurated the Souvenir published on the occasion of the Silver Jubilee Celebration of the Plasma Conference. Prof. Bora also delivered the Keynote Lecture of the conference on "Fusion A limitless energy source in the horizon".

Prof. P K Kaw and Prof. D. Bora greeted by Prof. Joyanti Chutia

Prof. Joyanti Chutia, Prof. P K Barhai and Prof. D. Bora on inauguration ceremony

A section of the participants of the conference

Prof. P K Kaw and other dignitaries at the exhibition of plasma experiment

This year an exhibition cum demonstration program of 6 experimental set up was organized in the conference venue by FCIPT-IPR, Gandhinagar. The exhibition was innugurated by Prof. P. K. Kaw just after the inauguration ceremony of the PLASMA 2010. Six experimental set up showing different plasma behaviour and measurement techniques were demonstrated live during the conference. The experiments have been designed for teaching M. Sc. Students in Indian Universities/Institutes.

Poster session

The Director, IASST hosted a dinner on 8th December, evening at IASST Campus, Boragaon and all participants attended the dinner. A cultural program was presented on 10th December, evening at the conference venue. Artists from Songs and Drama Division, Ministry of Cultural Affairs performed in the program.

PSSI in conjunction with external sponsors, has instituted many awards for outstanding research works in the area of Plasma Science & Technology. The following awards presented during conference. **The Buti Young Scientist Award went to** G. S. Gogna, Dublin University for his paper "The resonance hairpin probe-concept, theory and application in magnetized plasma". **Six poster awards for the best paper in the different categories were given.**

Closing ceremony

The prizes were presented at the closing ceremony of the conference on 11th December, 2010.

PSSI award pesentation by Prof. Avinash Khare, Delhi University, Newly elected President, PSSI.

DST-SERC School on Plasma Waves and Instabilities:

The 3rd DST- SERC School on Theory of Plasma Waves and Instabilities has been organized at IASST during 7-18 February, 2011. Initially the School was scheduled in the Month of December, 2010 and due to unavoidable circumstanced it has been postponed. 19 participants attended the school for the entire duration.

The 1st SERC School was organized at Birla Institute of Technology (BIT), Mesra on the topic " Science and Technology of Processing Plasmas" in 2008 followed by 2nd SERC School on "Plasma Diagnostics" at Institute for Plasma Research, Gandhinagar in 2009.

Brief statement of objectives of the school.

The purpose of the proposed school on Theory of Plasma Waves and Instabilities is to educate and motivate young researchers of the country working in the multidisciplinary areas of plasma research. The curriculum include introduction to the basic plasma physics, describe varieties of plasmas that exist naturally as well as produced in the laboratories. Introductory review lectures on the waves and instability of various kinds in plasmas followed by many lectures by experts on related fields have been delivered. Few laboratory experiments on excitation of linear and nonlinear waves and basic measurements to obtain propagation characteristics of the waves have been demonstrated. The lectures have also been augmented by few popular seminars by experts.The main target group has been young research scholars who have recently started doctoral work in the field of plasma physics and technology.

Felicitation of Resource Person

The school was inaugurated by Prof. Joyanti Chutia, Director, IASST on 7th February morning followed by a lecture on Basic Overview of Plasma Research by Dr. M P Bora, Reader, Gauhati university.

During the school 8 experts from different leading institutions and universities delivered lectures on various topics. Emmient persons who delivered their lectures were Prof. Nikhil Chakrabarty and Prof. M.S. Janaki, Saha Institute of Nuclear Physics; Prof. Vinod Kishan, Indian Institute of Astrophysics, Bangalore; Prof. Amita Das, Dr. N. Bisai, Dr. S. Sengupta and Prof. R Singh, Institute for Plasma Resaerch, Ahmedabad; Dr. S Ghosh, Kolkata University.

Dr. S K Baishya, Cotton College delivered a review lecture on theory of ion-acoustic waves. Four popular lectures have been delivered by Prof. A K Das, BARC Mumbai, Prof. A N Sekar Iyenger, SINP Kolkata, Prof. Amarendra Sarma, IIT Guwahati and Dr. Subrata Mukherjee, FCIPT-IPR Ahmedabad.

On the final day, all the participants presented their own research work and expressed their satisfaction attending the lectures during the school. Concluding session was chaired by Prof.

A section of DST SERC School participants.

15. Major Events

Celebration of Hindi Divas

14th September of every year has been celebrated as "Hindi Divas" in our country. This institute celebrated the occasion by holding a half-day programme. Mr. Ajoyendra Nath Trivedi, Deputy Chief Officer of UCO Bank, Regional Office at Guwahati honoured the occasion as Chief Guest. Professor Joyanti Chutia, Director, IASST presided over the meeting. The function started with a devotional song by the staff of IASST. In his welcome address Dr. Neelotpal Sen Sarma mentioned that it is the honour that the IASST earned for its hard work which ultimately leads the takeover of IASST as an autonomous institution under the Department of Science and Technology (Govt. of India). He also talked about the role and importance of the Hindi language as national language. The Director of IASST, Prof.

Dignitaries at the dias

Joyanti chutia in her speech said that india being a multilingual country with thousands of dialect, Hindi has come out as a people's language of communication helping further strengthening our unity as a nation. She added Hindi is our national language which carries with it the past history, old and rich culture, with science and literature. The people are able to express their views, ideas, share joy and sorrow with everybody living in different parts of the country with different mother tongues. So, it is utmost important to learn Hindi.

Mr. Ajoyendra Nath Trivedi addressing the gathering

Mr. Ajoyendra Nath Trivedi in his speech said Hindi written in Devanagari script has been taken as the official language in our country from several languages. An independent country is identified by its specific language and this gives the necessary moral boost for the people. From almost thousand years, may be in some other

Cultural function by research scholar's of IASST

form, Hindi had been acting as a connecting media among the people of India. During the freedom struggle, Hindi helps the country to unite itself as a single family. Amir Khusrau in the Middle Ages termed it 'Hindavi'. He told that a foreign language cannot be the medium of instruction for a country with self-respecting democratic governance.

Drawing competition organized as part of the celebration

If so, the nation's pride and efforts cannot be awakened. Inspired by this idea, builders of our country have taken the Hindi as the official language of the Union Government. He stressed the use of Hindi in a progressive way in all government offices to ensure proper upliftment of the society and nation.

Later songs in Hindi were sung and recitals were performed by the research students of the IASST and the children of the staff to celebrate the occasion. Drawing competition and essay writing competition were organized as part of the celebration and prizes distributed to the winners during the meeting.

The meeting ended with a vote of thanks from Dr. Mrs. Lipi. B. Mohanta.

Celebration of Science Day

Science Day was celebrated at IASST premises with zeal and enthusiasm on 28th Febraury 2011. The special guest for the celebration was eminent scientist and retired professor from Indian Institute of Technology Kharagpur, Prof. Sukumar Maity.

Felicitation of Prof. Maiti

The program was attended among others by Prof. N. N. Dass, former Director, IASST, faculty / students of Cotton College and some local college and students, staff and faculty of IASST.

Address by Prof. Joyati Chutia, Director, IASST

The program started with welcome speech by Dr. Neelotpal Sen Sarma, convener of the Science Day celebration. The Director, IASST, Prof. Joyanti Chuita in her speech welcomed Prof. Maiti who has agreed to come to Guwahati to grace the occasion. Prof. Chutia in her address pointed that 2011 is being observed as International Year of chemistry with the theme "Chemistry Our Life, Our future". She said that chemistry has become the central science in research and in many fields it is difficult to work without chemistry. Prof. N. N. Das, former Director IASST gave a brief introduction of special guest Prof. Sukumar Maity who is the distinguished scientist with vast experience of working in industry and academics institute in the country and abroad.

Section of audience

Address by Prof. Maity

In his speech, Prof. Maiti advised the student community to choose a career of their interest so that one can give 100% attention to the work. He said "you should love the work you are doing". He shared his experiences from his life that he moved from industry job which was very lucrative to academic job, a position at IIT Kharagpur only for his interest. Prof. Maiti in his speech also mentioned about famous scientists from India who have made significant contributions to science. He talked about Sir Jagdish Chandra Bose whom he said, deserved two Nobel Prize, one for Life of plant and other for wireless transmission. Prof. Maiti told that Jagdish Chandra Bose was the first to use semiconductor junctions to detect radio signals and he successfully demonstrated and transmitted his voice to his wife. He also stressed the need to look into the economic viability of research, and in this regard he noted the contribution of Prafulla Chandra Ray, chemist and entrepreneur. In the end part of his talk he gave a power point presentation titled "what can Polymer offer us". He talked about the different types of polymer, classification and different applications of polymers in various areas. His one hour talk was highly illuminating, informative and applauded by one and all present in the function. The function ended with a vote of thanks by Dr. Devasish Chowdhury, co-convener of the science day celebration.

Celebration of Vigilance Awareness Week at IASST

The Vigilance awareness week was celebrated in the Institute of Advanced study in Science and Technology for the first time. With the rest of the country, observance of Vigilance awareness week was commenced on 25th October, 2010 at the auditorium of IASST. Prof. Joyanti Chutia, Director of IASST presided over the meeting. Dr. Sabitry Choudhury Bordoloi, Vigilance Officer of IASST explained the importance of celebrating vigilance awareness week.

Prof.Joyanti Chutia, Director administering the Pledge.

At 11 AM Prof. Joyanti Chutia administered the pledge. All the faculty members and administrative staff participated in the programme. In her presidential address Prof. Joyanti Chutia emphasized the importance of a corruption free society for improving the quality of life of the masses. Prof. N.N.Dass, former Director of IASST explained how corruption has

cropped into our system and may cripple the administration in future. Faculty members, Sri Diganta Goswami, Registrar of the Institute and representative from staff also highlighted importance of transparency in the administration.

A view of the audience of IASST

Important highlight of the celebration was an illuminating and thought provoking presentation by Sri Hiren Chandra Nath, IPS and DIG, CBI, Govt. of India. He elaborated how vigilance and anti corruption action should be strong in maintaining corruption free public utility services. He also highlighted the lacunae in our system and how this can be corrected to maintain a corruption free society. The audience benefited immensely from his active interaction with the audience. Banner was displayed during the week and active interactions with members of IASST were arranged so that each and every member is made aware of the importance of being vigilant against corruption.

Sri Hiren Chandra Nath, IPS, DIG, CBI delivering his talk.

Farewell Meeting

Prof. N N Dass, ex Director, IASST, Dr. P Azad, Associate Prof, Life Sciences Division and Mr. G C Bhuyan, Finance and accounts officer of the Institute retired from their respective services after rendering dedicated service to the Institute for a long period. To recognized and appreciate their contribution towards the growth of the Institute from the initial state to this status, all the employees of IASST bade farewell on 7th January 2011 to these persons. The meeting was presided over by Prof. K M Pathak, former Chairman, Council of IASST and Prof. Barin Sharma of Physics Department; Gauhati University was the chief guest on the occasion.

The meeting was initiated with a very emotional lecture by the Director Prof J. Chutia, describing the sweet moments of these persons. Prof. N. N. Dass, Dr. P. Azad and Mr. G.C. Bhuyan were felicitated on the occasion. Many faculties and employees also offer their heartfelt gratitude for their services rendered to the Institute. The meeting was ended with vote of thanks.

Dignitaries at the dias

Prof. N. N. Dass being felicitated on the ocassion

Dr. P. Azad being felicitated on the ocassion

Mr. G.C. Bhuyan being felicitated on the ocassion

A view of the audience of IASST

Cultural program by research scholars of IASST

16. IASST Colloquium

01	Mr. Jyotirmoy Pramanik	Dept. of Physics Kharagpur College	4th June 2010	Study of linear and non linear waves in strongly coupled dusty plasma.
03	Mr. Arup Jyoti Choudhury	Material Sci. Div. IASST	16th July 2010	Perspectives on Plasma Science, Technology and application in 21st century.
04	Mr. Chandan K. Nath	Maths. Sci. Div. IASST	27th August 2010	Pattern recognition, Image processing and fuzzy logic and their application

Institutional Manpower

Director

Prof. Joyanti Chutia, Ph.D., FNASc.

Scientists & Staff

Material Sciences Division

Dr. Heremba Bailung, M. Sc., Ph. D.
Associate Professor II, Head (i/c)
Prof. Narendra Nath Dass, Ph. D., D. I. C.
Honorary Professor
Dr. Neelotpal Sen Sarma, M. Sc., M.Tech, Ph. D
Assistant Professor -II
Dr. Devasish Chowdhury, M. Sc., Ph. D
Assistant Professor-II
Dr. Arup Ratan Pal, M. Sc., Ph. D
Assistant Professor-II
Dr. Nirab Chandra Adhikary, M. Sc.,Ph.D
Technical Officer-B

Mr. Manoj Kumar Deka, M. Sc.	SRF
Ms. Sumita Kumari Sarmah, M. Sc.	SRF
Mr. Samiul Hoque, M. Sc.	SRF
Mr. Arup Jyoti Choudhury, M. Sc.	SRF
Ms. Dolly Gogoi, M. Sc.	JRF
Ms. Shyamalima Sharma, M. Sc.	JRF
Ms. Porimita Saikia, M. Sc.	JRF
Mr. Lakshinandan Goswami, M. Sc.	JRF
Ms. Priyanka Dutta, M. Sc	JRF
Mr. Tapan Barman, M. Sc.	JRF
Mr. Bhabesh Kumar Nath, M. Sc.	JRF
Mr. Amarjyoti Kalita, M. Sc.	JRF
Mr. Ranjan Kalita, M. Sc.	JRF
Mr. Krishna Kanta Swargiary	Technician
Mr. Bipul Kumar Das	Multi-Tasking staff
Mr.Niren Sarma	Multi-Tasking staff

Life Sciences Division

Dr. Jibon Kotoky, M. Sc., Ph. D
Associate Professor II & Head (i/c)
Dr.(Mrs.). Dipali Devi, M. Sc., Ph. D
Associate Professor I
Dr. (Mrs) Rajlakhi Devi, M. Sc., Ph. D
Assistant Professor II

Mr. Dulal Barua M. Sc.	SRF
Mr. Kaustav K. Sharma, M. Sc.	SRF
Ms. Tilottama Mudoi, M. Sc.	SRF
Ms. Bedabati Dasgupta	SRF
Mr. Jitendra Kumar Das, M. Sc.	JRF
Ms. Ananya Barman, M. Sc.	JRF
Mr Manash Jyoti Das, M. Sc.	JRF
Ms. Sushmita Bose Roy, M. Sc.	JRF
Mr. Bijit Talukdar, M. Sc.	JRF
Mrs. Phulmoni Chaudhury, M. Sc.	JRF
Mr. Saranga Dutta, M. Sc.	JRF
Ms. Mousumi Saikia, M. Sc.	JRF
Mr. Krishna Kanta Sarma	Field Assistant
Mrs. Julie Bordoloi	Technical Assistant
Mr. Subrata Goswami	Technical Assistant
Mr. Tarun Talukdar	Multi-Tasking staff
Mr. Bolin Das	Multi-Tasking staff
Mr. Sabin Kalita	Multi-Tasking staff

Resource Management & Environment Division

Dr. (Mrs) Sabitry Choudhury Bordoloi, M. Sc., Ph. D
Associate professor II and Head (i/c)
Dr.Suresh Deka, M. Sc., Ph. D
Associate professor II
Dr.Arundhuti Devi, M. Sc., Ph. D
Assistant professor II
Dr. Hamen Sarma M. Sc., Ph. D
Post Doctoral Fellow

Ms. Rashmi Rekha Saikia, M. Sc	JRF
Mr. Hemen Deka, M. Sc	JRF
Mr. Mrinal Kr.Das, M. Sc	JRF
Mr. Rubul Saikia, M. Sc	JRF
Mr. Budhadev Basumatari, M. Sc	JRF
Ms Chatoan Tesia, M. Sc	JRF
Ms.Sonali Barpatra Gohain, M. Sc	JRF
Ms. Debahuti Goswami, M. Sc	JRF
Surabhi Buragohain, M. Sc	JRF
Mr. Pinku Bora	Project Assistant
Mr. Himanshu Deka	Project Assistant
Ratul Bezbaruah	Project Assistant
Mr. Ailek Chekap	Field Attendant
Mr. Dhaneswar Boro	Field Attendant
Mr. Manmohan Huzuri, B.Sc.	Technical Assistant
Mr. Madan Kalita	Multi-Tasking staff

Mathematical Sciences Division

Dr. Binod Chandra Tripathy, M.Sc, Ph.D.
Associate Professor II and Head (i/c)

Prof. Jyoti Prasad Medhi, M.Sc., D.Sc.	Honorary Professor
Prof. Ganesh Chandra Das, M.Sc., Ph.D.	Honorary Professor
Dr. Gautam Choudhury, M.Sc., Ph.D.	Associate Professor I
Dr. (Mrs) Lipi B. Mahanta, M.Sc., Ph.D.	Assistant Professor II
Dr. Amar Jyoti Dutta, M.Sc., Ph.D.	Research Associate
Ms Rupa Chakraborty, M.Sc.	JRF
Mr. Chandan Kumar Nath, M.Sc.	JRF
Ms. Pallavi Saikia, M.Sc., M.Phil.	JRF
Ms Nijara Rajbongshi, M.Sc.	JRF
Ms Tanushree Deb Roy, M.Sc.	Research Officer
Ms Rangmili Gogoi Dutta, M.Sc.	Research Assistant
Mr. Balabhadra Pathak	Multi-Tasking staff

Internet Service Centre

Mr. Anupam Barman	Assistant Professor II and In charge
Mr. Niranjan Bhagaboti	Technical Officer B

Knowledge Resource Center

Mr. Tarini Dev Goswami, M.L.I.Sc.; M.Phil	Assistant Librarian, i/c KRC
Mr. Kumud Baishya,	Assistant-I
Mrs. Sarala Deka,	Multi-Tasking staff
Mr. Rahul Sarma, M.L.I.Sc; PGDCA	Library Trainee
Ms. Bijoya Ray, M.L.I.Sc	Library Trainee

Administrative Staff

Mr. Diganta Goswami	Registrar
Mr. Ganesh Ch. Bhuyan	Finance & Accounts Officer
Mr. Rajesh Sharma	PRO
Mr. Prabodh Kr. Deka	Section Officer
Mr. Suresh Ch. Sarma	Section Officer
Mr. Lelin Gogoi	PS to Director
Mr. Rabin Ch. Kalita	Sr. Superintendent
Mr. Ramen Mahanta	Sr. Superintendent
Mrs. Saraswati Bora	Sr. Superintendent
Mr. Montu Deka	Junior Engineer
Mr. Dwijen Ch. Deka	Assistant
Mr. Diganta Das	Assistant
Mr. Prabhat Ch. Barma	Assistant
Mr. Gora Gupta	Assistant
Mr. Babul Ch. Deka	Multi-Tasking staff
Umesh Ch. Deka	Multi-Tasking staff
Lakshmi Kanta Saud	Multi-Tasking staff
Mrs. Madhabi Das	Multi-Tasking staff
Nripen Ch. Goswami	Multi-Tasking staff
Satish Ch. Das	Multi-Tasking staff
Haren Medhi	Multi-Tasking staff
Ratul Baishya	Multi-Tasking staff
Mr. Binoy Kr. Choudhury	Multi-Tasking staff
Mr. Pradip Das	Multi-Tasking staff
Srikanta Baishya	Multi-Tasking staff
Mr. Nimai Hazam	Driver
Mr. Phatik Baishya	Driver
Munna Basfor	Sweeper

Technical Staff

Mrs. Juri Pathak	Technical Officer A
Mr. Munindra Singh	Technical Assistant
Mr. Madhu Ram Kalita	Multi-Tasking staff

Visitors

Prof. Milan Sanyal, Director, SINP studing a specimen in biodiversity museum

Prof. Milan Sanyal, Director, SINP visiting biodiversity museum

Prof. Sandeep Kumar from Raman Research Institute, Bangalore giving a lecture at IASST

Students from North Bengal University, Cooch Behar visiting Seri biotech unit.

School students visiting life sciences laboratory

Participents of SERC sponsored plasma school busy with experiments

Contact Information of Faculty Members

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Institute of Advanced Study in
Science and Technology Guwahati, Assam

Auditor's Report and Statements of Account

For The Year Ended 31st March 2011

M. SAQUEI & CO.
CHARTERED ACCOUNTANTS

M. SAQUEI HOUSE
48, DIGHALIPUKHURI EAST
GUWAHATI - 781001
TEL: 2131239
FAX: 2545881

AUDITOR'S REPORT
TO THE MEMBERS OF
INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY, GUWAHATI

1. We have examined the attached balance sheet of **INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY, GUWAHATI** as at 31st March, 2011 and the Income and Expenditure Account for the year ended on that date annexed thereto, both of which we have signed under reference to this report. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our audit.

2. We conducted our audit in accordance with auditing standards generally accepted in India. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

3. We further report that:-

   (a) We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purposes of our audit.
   (b) In our opinion, proper books of account have been kept by the Institute so far as appears from our examination of such books.
   (c) The Balance Sheet and the Income and Expenditure Account referred to in this report are in agreement with the books of account.
   (d) In our opinion and to the best of our information, and according to information given to us, and subject to the notes on accounts, the said accounts give the information in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India-
      i) in the case of the Balance Sheet, of the state of affairs of the Institute as at 31st March, 2011; and
      ii) in the case of the Income and Expenditure Account, of the income and expenditure of the Institute for the year ended on that date.

For M. Saquei & Co.,
Chartered Accountants

Reefat Saquei
Partner
(Membership No. 058118)

Guwahati; 20th June, 2011

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI

BALANCE SHEET AS AT 31ST MARCH 2011

(AMOUNT IN RS.)

	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
CAPITAL FUND AND LIABILITIES			
CAPITAL FUND	1	13,58,84,395.96	11,02,43,315.96
RESERVES AND SURPLUS	2	-	-
EARMARKED / ENDOWMENT FUNDS	3	-	-
SECURED LOANS AND BORROWINGS	4	-	-
UNSECURED LOANS AND BORROWINGS	5	-	-
DEFERRED CREDIT LIABILITIES	6	-	-
CURRENT LIABILITIES AND PROVISIONS	7	4,23,68,858.40	3,77,32,665.62
TOTAL		17,82,53,254.36	14,79,75,981.58
ASSETS			
FIXED ASSETS	8	13,98,66,569.00	11,42,25,489.00
INVESTMENTS - FROM EARMARKED / ENDOWMENT FUNDS	9	-	-
INVESTMENTS - OTHERS	10	23,49,608.00	23,49,608.00
CURRENT ASSETS, LOANS AND ADVANCES	11	3,60,37,077.36	3,14,00,884.58
TOTAL		17,82,53,254.36	14,79,75,981.58
SIGNIFICANT ACCOUNTING POLICIES	16		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	17		

In terms of our separate report of even date.

For M. Saquei & Co.,
Chartered Accountants

Reefat Saquei
Partner

Guwahati; 20th June, 2011

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2011

(AMOUNT IN RS.)

	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
INCOME			
Grants	12	5,80,66,690.22	4,44,26,223.38
Interest Earned	13	13,64,906.00	5,28,544.00
Other Income	14	36,798.00	12,83,758.00
TOTAL		5,94,68,394.22	4,62,38,525.38
EXPENDITURE			
Expenditure on Grants	15	5,94,68,394.22	4,62,38,525.38
TOTAL		5,94,68,394.22	4,62,38,525.38
BALANCE BEING SURPLUS / (DEFICIT)		-	-
PRIOR PERIOD ADJUSTMENTS		-	-
BALANCE BEING SURPLUS / (DEFICIT) TRANSFERRED TO CAPITAL FUND		-	-
SIGNIFICANT ACCOUNTING POLICIES	16		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	17		

In terms of our separate report of even date.

For M. Saquei & Co.,
Chartered Accountants

Riefat Saquei
Partner

Guwahati, 20th June, 2011

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2011

(AMOUNT IN RS.)

SCHEDULE 1 - CAPITAL FUND:	CURRENT YEAR	PREVIOUS YEAR
As per last Account	11,02,43,315.96	8,90,68,650.96
Add: Contributions towards Capital Fund	2,86,94,279.00	2,11,74,665.00
	13,89,37,594.96	11,02,43,315.96
Deduct: Depreciation for the year	30,53,199.00	-
	13,58,84,395.96	11,02,43,315.96
Add / (Deduct): Surplus / (Deficit) transferred from Income and Expenditure Account	-	-
TOTAL	13,58,84,395.96	11,02,43,315.96

SCHEDULE 2 - RESERVES AND SURPLUS:	CURRENT YEAR	PREVIOUS YEAR
	-	-
TOTAL	-	-

SCHEDULE 3 - EARMARKED / ENDOWMENT FUNDS:	CURRENT YEAR	PREVIOUS YEAR
	-	-
TOTAL	-	-

SCHEDULE 4 - SECURED LOANS AND BORROWINGS:	CURRENT YEAR	PREVIOUS YEAR
	-	-
TOTAL	-	-

SCHEDULE 5 - UNSECURED LOANS AND BORROWINGS:	CURRENT YEAR	PREVIOUS YEAR
	-	-
TOTAL	-	-

SCHEDULE 6 - DEFERRED CREDIT LIABILITIES:	CURRENT YEAR	PREVIOUS YEAR
	-	-
TOTAL	-	-

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2011

(AMOUNT IN RS.)

SCHEDULE 7 - CURRENT LIABILITIES AND PROVISIONS:	CURRENT YEAR		PREVIOUS YEAR	
A. CURRENT LIABILITIES:				
Unutilised Grant-in-aid	3,23,02,729.40		2,85,74,031.62	
Other Current Liabilities	99,95,468.00		91,40,569.00	
Earnest Money	70,661.00		18,065.00	
TOTAL (A)		4,23,68,858.40		3,77,32,665.62
B. PROVISIONS:		-		-
TOTAL (B)		-		-
TOTAL (A+B)		4,23,68,858.40		3,77,32,665.62

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI

SCHEDULES FORMING PART OF THE BALANCE SHEET AS AT 31ST MARCH 2011

(AMOUNT IN RS.)

SCHEDULE 8 - FIXED ASSETS

DESCRIPTION	GROSS BLOCK				DEPRECIATION			NET BLOCK	
	COST / VALUATION AS ON 01.04.2010	ADDITIONS DURING THE YEAR	DEDUCTIONS DURING THE YEAR	COST / VALUATION AS ON 31.03.2011	AS AT 01.04.2010	FOR THE YEAR	AS AT 31.03.2011	AS AT 31.03.2011	AS AT 31.03.2010
A. FIXED ASSETS									
1. BUILDING AND SITE DEVELOPMENT	7,85,06,520.00	6,08,273.00	-	7,85,14,793.00	-	12,79,858.00	12,79,858.00	7,79,35,237.00	7,85,06,520.00
2. EQUIPMENTS	2,75,48,576.00	2,41,09,718.00	-	5,16,58,294.00	-	13,08,557.00	13,08,557.00	5,03,49,737.00	2,75,48,576.00
3. VEHICLES	10,88,194.00	-	-	10,88,194.00	-	1,03,378.00	1,03,378.00	9,84,816.00	10,88,194.00
4. FURNITURE AND FIXTURES	15,85,155.00	16,73,805.00	-	32,68,960.00	-	1,08,973.00	1,08,973.00	31,67,987.00	15,85,155.00
5. LIBRARY	54,87,044.00	25,00,483.00	-	79,87,527.00	-	2,68,835.00	2,68,835.00	77,18,692.00	54,87,044.00
TOTAL	11,42,25,489.00	2,88,94,279.00	-	14,25,15,768.00	-	30,53,199.00	30,53,199.00	13,96,66,569.00	
PREVIOUS YEAR	9,28,15,625.00	2,14,09,864.00	-	11,42,25,489.00	-	-	-		11,42,25,489.00
B. CAPITAL WORK-IN-PROGRESS								-	-
TOTAL								13,96,66,569.00	11,42,25,489.00

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2011

	CURRENT YEAR	PREVIOUS YEAR
SCHEDULE 9 - INVESTMENTS FROM EARMARKED / ENDOWMENT FUNDS:	-	-
TOTAL	-	-

	CURRENT YEAR	PREVIOUS YEAR
SCHEDULE 10 - INVESTMENTS - OTHERS:		
In Term Deposits	23,49,608.00	23,49,608.00
TOTAL	23,49,608.00	23,49,608.00

	CURRENT YEAR		PREVIOUS YEAR	
SCHEDULE 11 - CURRENT ASSETS, LOANS AND ADVANCES:				
A. CURRENT ASSETS:				
Cash Balances in Hand	10,000.00		10,072.00	
Bank Balances:				
With Scheduled Banks on Current / Deposit / Savings Accounts	1,62,33,058.36	1,62,43,058.36	1,52,21,610.58	1,52,31,682.58
B. LOANS, ADVANCES AND OTHER ASSETS:				
Loans:				
Staff		7,71,695.00		
Advances and other amounts recoverable in cash or in kind or for value to be received:				
On Capital Account :				
Advance for Equipments	1,76,68,939.00		1,43,84,364.00	
Advance for Consumables	-		4,31,453.00	
Advance for Library	13,53,385.00	1,90,22,324.00	13,53,385.00	1,61,69,202.00
TOTAL		3,60,37,077.36		3,14,00,884.58

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2011

(AMOUNT IN RS.)

	CURRENT YEAR		PREVIOUS YEAR	
SCHEDULE 12 - GRANTS:				
Irrevocable Grants	9,14,81,000.00		9,41,74,920.00	
	9,14,81,000.00		9,41,74,920.00	
Add: Unutilised Grant brought forward	2,85,74,031.62		-	
	12,00,55,031.62		9,41,74,920.00	
Deduct: Transferred to Capital Fund (Grants utilised for capital expenditure)	2,86,94,279.00		2,11,74,665.00	
	9,13,60,752.62		7,30,00,255.00	
Deduct: Refund of Unutilised Grant	9,91,333.00		-	
	9,03,69,419.62		7,30,00,255.00	
Deduct: Unutilised Grant carried forward	3,23,02,729.40	5,80,66,690.22	2,85,74,031.62	4,44,26,223.38
TOTAL		5,80,66,690.22		4,44,26,223.38

(AMOUNT IN RS.)

	CURRENT YEAR	PREVIOUS YEAR
SCHEDULE 13 - INTEREST EARNED:		
On Savings Accounts with Scheduled Banks	13,64,906.00	5,28,544.00
TOTAL	13,64,906.00	5,28,544.00

	CURRENT YEAR	PREVIOUS YEAR
SCHEDULE 14 - OTHER INCOME:		
Other Income	36,798.00	12,83,758.00
TOTAL	36,798.00	12,83,758.00

	CURRENT YEAR	PREVIOUS YEAR
SCHEDULE 15 - EXPENDITURE ON GRANTS ETC.:		
Expenditure against Grants for Specific Projects / Schemes:		
Salary / Staff Benefits	4,19,17,846.00	3,51,09,875.00
Contingencies	37,19,186.22	38,94,493.38
Honorarium / Fellowship	24,00,388.00	1,71,225.00
Training / Conference / Workshops	22,79,954.00	13,420.00
Travel	9,23,565.00	11,17,554.00
Consumables	38,02,254.00	35,10,905.00
Works and Services	40,40,870.00	13,94,504.00
Green House	-	65,149.00
Financial Assistance	-	9,61,400.00
Security Services	3,84,331.00	-
TOTAL	5,94,68,394.22	4,62,38,525.38

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI – 781 035
ASSAM

Schedule Forming Part of the Accounts for the year ended on 31st March, 2011

Schedule 16 - Significant Accounting Policies

1. ACCOUNTING CONVENTION
   The financial statements are prepared on the basis of historical cost convention, unless otherwise stated and on the accrual method of accounting.

2. REVENUE RECOGNITION
   Income on interest bearing securities and term deposits is recognized on cash basis as and when these are realized.

3. INVESTMENTS
   Term deposits with Banks are taken as investments and are stated at cost.

4. FIXED ASSETS
   Fixed Assets are stated at cost of acquisition inclusive of inward freight, duties and taxes and incidental and direct expenses related to acquisition.

5. DEPRECIATION

   - Depreciation on fixed assets purchased / acquired / constructed out of Government Grants is charged on Straight Line Method as per the rates specified under the Companies Act, 1956.
   - Depreciation is charged to Capital Fund by way of reducing the net value of fixed assets.
   - No depreciation is charged on fixed assets purchased / acquired / constructed during the year.
   - No depreciation is charged on assets sold / discarded / demolished or destroyed during the year.
   - Depreciation is charged to the extent of 95% of the its book value and thereafter, shown at 5% of the book value.

6. GOVERNMENT GRANTS / SUBSIDIES
   - Grants are shown as income on realization basis and expenditure thereof is charged to appropriate revenue heads. In the case of expenditure of capital nature out of such grants, the respective fixed assets are debited and credit to the same extent is taken to the Capital Fund.
   - Grants utilized during the year towards acquisition of fixed assets are credited to Capital Fund.

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI – 781 035
ASSAM

Schedule Forming Part of the Accounts for the year ended on 31st March, 2011

Schedule 17 – Notes On Accounts

i) Interest earned / accrued on term deposits on renewal, if any, are yet to be accounted.

ii) No provision has been made in respect of leave salary.

iii) Purchase of consumable items during the year are treated as expenditure and charged to revenue.

iv) In the opinion of the Management, the current assets, loans and advances have a value on realization equal or at least to the aggregate amount shown in the Balance Sheet.

v) Balances under Current Liabilities, Loans and Advances are subject to confirmation / reconciliation / adjustments, if any.

vi) No provision is made for any contingent liability except for cases where provision needs to be made based on expert opinion.

vii) Previous year's figures have been rearranged and regrouped wherever considered necessary to facilitate comparison.

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
PASCHIM BORAGAON, GARCHUK, GUWAHATI

RECEIPT AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2011

(AMOUNT IN RS.)

	SCHEDULE	CURRENT YEAR	PREVIOUS YEAR
RECEIPT			
Grants		9,14,81,000.00	9,41,74,920.00
Interest Earned		13,64,906.00	5,28,544.00
Other Income		36,798.00	12,83,758.00
Earnest Money		52,596.00	18,065.00
Outstanding Liabilities		19,34,776.00	35,78,838.00
TOTAL		**9,48,70,076.00**	9,95,84,125.00
PAYMENT			
Expenditure on Grants		5,94,68,394.22	4,62,38,525.38
Acquisition of Fixed Assets		1,38,78,462.00	2,14,09,864.00
Advances for Equipments		1,76,68,939.00	1,61,69,202.00
Advances to Staff		7,71,695.00	-
Earnest Money		-	6,500.00
Security Deposit		-	7,310.00
Refund of Unutilised Grant		9,91,333.00	-
Outstanding Liabilities		10,79,877.00	26,95,393.00
TOTAL		**9,38,58,700.22**	8,65,26,794.38
OPENING BALANCE		**1,52,31,682.58**	**21,74,351.96**
EXCESS OF RECEIPT OVER PAYMENT / (EXCESS OF PAYMENT OVER RECEIPT)		**10,11,375.78**	**1,30,57,330.62**
CLOSING BALANCE		**1,62,43,058.36**	**1,52,31,682.58**

In terms of our separate report of even date.

For M. Saquei & Co.,
Chartered Accountants

Partner

Guwahati; 20th June, 2011

Our Collaborators

Foreign

- Yokohama National University, Japan
- University of Maryland, USA
- University of Illinois at Urbana Champaign, USA
- Weizmann Institute of Science, Israel
- Shanhai Second Medical University, Shanhai, China
- Paduva University, Italy
- Deakin University, Australia
- Muséum national d'Histoire naturelle, Paris, France
- The University of Sydney, Sydney, Australia
- University of Ulster, Northern Ireland, U.K
- University of Botswana, BOTSWANA
- Firat University, Turkey
- Adiyaman University, Turkey
- National Taichung Institute of Technology, Taiwan, Republic of China
- American University in Dubai, United Arab Emeratus.
- University of Missouri-Kansas City, USA

National

- BARC, Mumbai
- Indian Institute of Science, Banglore
- Indian Institute of Technology, Khargpur
- Indian Institute of Technology, Guwahati
- Indian Institute of Chemical Technology (IICT), Hyderabad
- Gauhati University, Guwahati
- Centre for Advanced Technology, Indore
- CDRI, Lucknow, India
- IITR, Lucknow
- ITRC, Lucknow
- Dibrugarh University
- Saurastra University, Rajkot, Gujrat.
- Manipur University
- AIIMS, New Delhi
- Central Food Technological Research Institute, Mysore
- Veterinary College, Guwahati
- Indian School of Learning Jharkhand
- The Energy Resource Institute (TERI), New Delhi
- Sastra University, Tanjore
- Satyabhama University, Chennai,
- Nayagarh College, Orissa
- Information Technology (ICSIT), Kolkata Recognition, Learning Models
- B. Barooah Cancer Research Institute, Guwahati

Editorial Board

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Ms. Porimita Saikia

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Director, IASST

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2011

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

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