



ISRO-UoP Space Technology Cell University of Pune



**ANNUAL REPORT
2012-13**



Scrutiny of new research proposals

**ISRO-UoP
Space Technology Cell**

University of Pune



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SUMMARY

This document presents the details of the activities of ISRO-UoP Space Technology Cell (STC) at the University of Pune, during the year 2012-13. A brief report on the completed projects, giving the summary of findings, is included in this document. Similarly details of ongoing projects including the objectives of the new research projects sanctioned under ISRO-UoP Joint Research Programme are given.

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1. Introduction

Space activities in the country started during early 1960s with the scientific investigation of upper atmosphere and ionosphere over the magnetic equator that passes over Thumba near Thiruvananthapuram using small sounding rockets. Aim was to utilize space technology in fulfilling national goals and thereby promoting socio-economic benefits to the country. Indian Space programme, in the beginning, concentrated on achieving self reliance and developing capability to build and launch communication satellites for television broadcast/telecommunications/meteorological applications and remote sensing satellites for management of natural resources. Department of Space (DOS) implements these programmes through, mainly Indian Space Research Organization (ISRO). ISRO has now operationalised two major satellite systems namely Indian National Satellites (INSAT) for communication services and Indian Remote Sensing (IRS) satellites for management of natural resources. Also, Polar Satellite Launch Vehicle (PSLV) for launching IRS type of satellites and Geostationary Satellite Launch Vehicle (GSLV) for launching INSAT type of satellites have been developed and are being produced in required numbers. ISRO envisages development of cutting edge technologies such as advanced semi-cryogenic propulsion, air-breathing propulsion, satellite based navigation, high resolution imaging sensors etc for their future programmes which include advanced communication satellite, Reusable launch vehicle, Human Space Flight and Inter planetary missions. ISRO performs these activities through its various Centers/Laboratories spread all over the country and intends to establish strong links with academic Institutions to carryout quality research and derive useful outputs of such R&D to support its programmes. ISRO has set up Space Technology Cells at premiere institutions like Indian Institute of Technologies (IITs) - Bombay, Kanpur, Kharagpur and Madras; Indian Institute of Science (IISc), Bangalore and Joint Research Programme with the University of Pune (UoP) to carry out research activities in the areas of space technology and applications. These STCs and JRP are guided by Joint Policy Committees (JPCs) chaired by Director/Vice Chancellor of the respective institution and with members from ISRO/DOS (Senior Scientists/Engineers) & the respective institution. Under the STCs and JRP, research projects are taken up by the faculty of the Institute/University.

A Memorandum of Understanding (MOU), initiating Joint Research Programme (JRP), was signed between Chairman ISRO and Vice Chancellor University of Pune on 21 January 1998. To begin with, the Joint Research Programme focused on research areas comprising (i) Origin of life (ii) Space Radiation (iii) Wind measurements & modeling (iv) Optical coatings & sensors and (v) Rural development & developmental communication. The co-operation between the two organizations had been found beneficial and as a result, while renewing the MOU on 24 February 2006, these areas were enlarged by identifying six new disciplines. Additional areas where more emphasis could be laid on are (i) Geo-informatics (ii) Remote sensing applications (iii) Material Sciences (iv) Biodiversity (v) Instrumentation and (vi) Image processing. JRP programme is believed to enhance academic base, generate quality human resources and infrastructure at the academic Institution to support the space programme.

2. Management of Joint Research Programme

Under ISRO-UoP Joint Research Programme, emphasis has been on promoting research and applications in Space Science and Technology. A Joint Policy Committee (JPC), constituted jointly by Vice Chancellor, University of Pune and Chairman, ISRO with appropriate representation from both ISRO and University of Pune supervises the overall management of the Interaction Programme, recommends the funds requirement for the approved and the planned programmes to ISRO HQs and suggests new areas of activities as and when necessary. The Hon. Director, ISRO-UoP STC, is responsible for the administration, fund utilization and day-to-day functioning of the STC. Following were the JPC Members during the year 2012-13 with Vice Chancellor, University of Pune, as ex-officio Chairman.

Joint Policy Committee (JPC)

Prof (Dr) W N Gade, Vice Chancellor, UoP	Chairman
Dr MYS Prasad, Director, SDSC/ISRO	Member
Dr JA Kamalakar, Director, LEOS/ISRO	Member
Dr S Aravamuthan, Dy Director, PCM, VSSC/ISRO	Member
Shri VS Palsule, Director, DECU/ISRO	Member
Dr CBS Dutt, Group Director, ESAG, NRSC/ISRO	Member
Shri MS Anurup, Dy Director, LVPO, ISRO HQs	Member
Dr K Ganesh Raj, Dy Director, RESPOND, ISRO HQs	Member
Prof S Ananthakrishnan, Adjunct Professor & Raja Ramanna Fellow	Member
Shri P P Kale, Director, VLSI	Member
Dr V B Gaikwad, Director, BCUD, UoP	Member
Dr Dilip D Dhavale, Head, Dept of Chemistry, UoP	Member
Dr P Pradeep Kumar, Head, Dept of Atm and Space Sciences, UoP	Member
Prof P B Vidyasagar & Prof S I Patil, Head, Dept of Physics, UoP	Member
Dr A D Sahasrabudhe, Director, College of Engineering, Pune	Member
Smt Vidya K Gargote, Finance & Accounts Officer, UoP	Member
Shri M C Uttam, Hon Director, ISRO-UoP STC	Member Secretary

Preliminary Evaluation Committee (PEC)

The Joint Research Programme is co-ordinated and assisted by Preliminary Evaluation Committee (PEC). This Committee carries out preliminary evaluation of new research proposals received under ISRO-UoP Joint Research Programme in University of Pune and interacts with the Investigators for effecting any changes in their proposals. The proposals recommended by the Committee are examined by the Joint Policy Committee for final approval. PEC also reviews the progress of the ongoing projects on a regular basis. Following were the PEC Members during the year 2012-13:

Dr S Ananthakrishnan (Adjunct Professor & Raja Ramanna Fellow)	Chairman
Shri P P Kale, Director, VLSI	Member
Dr V B Gaikwad, Director BCUD, UoP	Member
Prof P B Vidyasagar & S I Patil, Head, Dept of Physics, UoP	Member
Prof Dilip D Dhavale, Head, Dept of Chemistry, UoP	Member
Dr (Mrs) Deepti Deobagkar, Head, Dept of Bioinformatics, UoP	Member
Smt Vidya K Gargote, Finance & Accounts Officer, UoP	Member
Shri M C Uttam, Hon. Director, ISRO-UoP STC	Member Secretary

3. Completed Research Projects

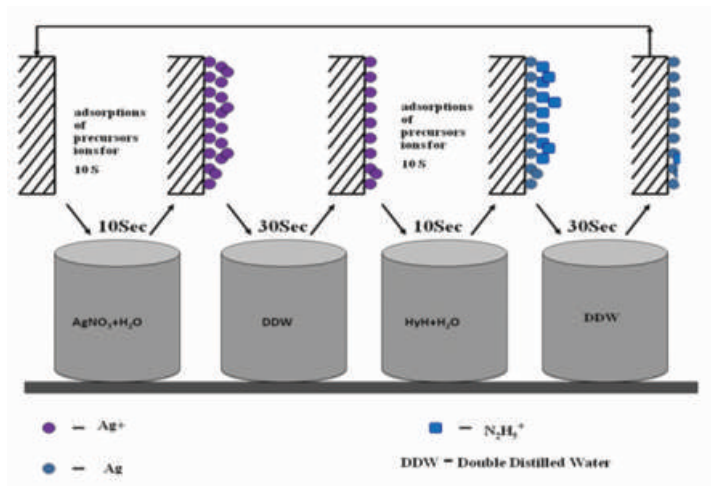
Beginning in 1998-99, a total of 135 research projects were undertaken by the various departments of the University and its affiliated colleges under ISRO-UoP Joint Research Programme and 104 of these projects were completed in the previous years ending in March 2012. During the year 2012-13 studies in respect of four more projects, as listed below, have been completed and final technical reports received from the Investigators. Summary of findings of these projects is given in the subsequent paragraphs. Summary of findings of the recently completed projects is also made available on University website. In order to bring the results of the study to the notice of ISRO Scientists/Engineers, brief details along with summary of findings of the completed research projects are published from time to time and copies of full technical reports of the completed projects are sent to the concerned libraries of ISRO Centres.

1. Chemical deposition of layered transition metal chalcogenides to study their tribological properties (Project no.106)
2. Chemical deposition of CuInSe₂, CdS and ZnO thin films for solar cell applications (Project no.108)
3. A comparative study of telecommunication technology: Its impact and relevance on Urban, Rural and Tribal community of Maharashtra (Project no.110)
4. Impact of low and high radiation doses on the nutritional quality, functional properties and shelf life of various foods (Project no.112)

PROJECT NO	106
TITLE	Chemical deposition of layered transition metal chalcogenides to study their tribological properties
INVESTIGATORS	Dr SD Sartale, Dept of Physics, UoP
DURATION	2 years (Started on: April 2010)
BUDGET (₹)	7,00,000

SUMMARY OF FINDINGS

Aim of the study was to design and develop a mechanism for synthesis of Layered Transition Metal Chalcogenide (LTMC) and metal thin films using Successive Ionic Layer Adsorption and Reaction (SILAR) method. Silver and palladium metal thin films were deposited and different deposition parameters studied. Particle size of silver and palladium thin films increases as concentration of either metal precursor or hydrazine hydrate (reducing agent) increases. In the case of silver thin films, as number of deposition cycles increases, the thickness of the film and particle size increases showing quadrupolar behavior in surface plasmon resonance (SPR) studies. Effect of external agitation (ultrasonication) and post deposition treatment (annealing) on silver thin films were also studied. Ultrasonic deposition increases the particle size and improves the size distribution. Thermal annealing at about 300 °C, causes suppression of dipole plasmon band and appearance of quadrupolar behavior. Based on the results of silver thin films, nickel thin film was also deposited and studied. This can act as a good TPL. SILAR process to deposit LTMC (MoS_2) thin films has been studied. Instead of taking Mo (cationic) and S (anionic) sources separately, a Mo-S complex was formed and maintaining its pH value, Mo was reduced using NaBH_4 thereby forming MoS_2 thin film. Using Van der Waals Rheotaxy (VdWR) process and SILAR deposited Ni thin film as TPL, type-II LTMC (MoS_2) thin films could be realized. These are having potential for use as solid lubricant



Schematic representation for deposition of silver thin films by SILAR method

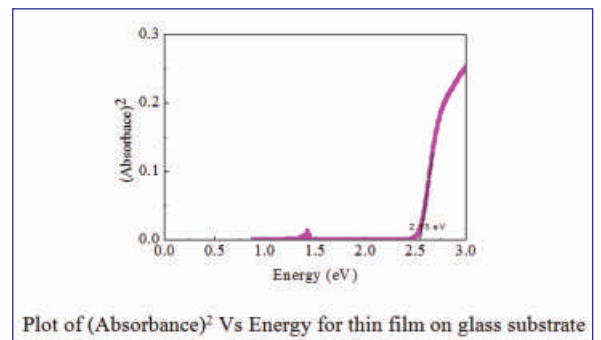
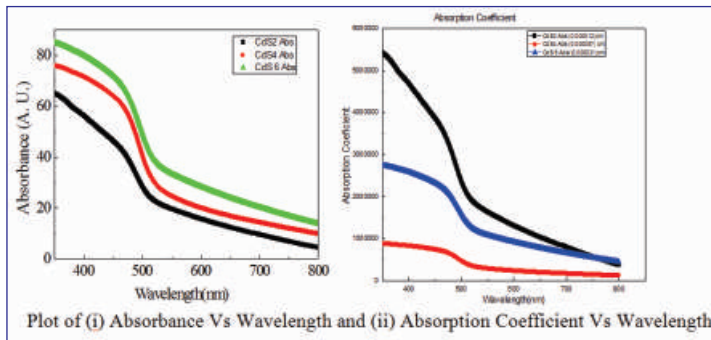
PROJECT NO 108
TITLE Chemical deposition of CuInSe₂, CdS and ZnO thin films for solar cell applications
INVESTIGATORS Dr Habib M Pathan, Dept of Physics, UoP
DURATION 2 years (Started on: April 2010)
BUDGET (₹) 9,00,000

SUMMARY OF FINDINGS

Aim of the project was to chemically synthesize thin films of CuInSe₂ (absorber), CdS (buffer) and ZnO (window) and characterize them to fabricate device for solar energy application. Experimental setup has been designed for adopting chemical bath deposition (CBD) and electrodeposition (ED) techniques. CuInSe₂ was deposited using chemical bath deposition and electrochemical deposition techniques. Buffer layer, CdS and the window material, ZnO were deposited using chemical bath deposition method. These films were characterized for structural, optical, surface morphological and compositional properties by means of X-ray diffraction, UV-VIS absorption spectroscopy, scanning electron microscopy and energy dispersive absorption spectroscopy. Multi-junctions were fabricated and I-V characteristics studied using optical microscopy. Targeted and the achieved parameters for these films are given in the following Table:

Film Material	Targeted parameters		Achieved parameters	
	Thickness (nm)	Band Gap (eV)	Thickness (nm)	Band gap (eV)
CdS	50	2.40	50	2.5
ZnO	100	3.00	100	3.3
CuInSe ₂	1000-2000	1.05	1000	1.0

Performance of solar cell depends on the optical properties of buffer layer. To study these properties, CdS film was deposited on glass substrate for different deposition durations and Absorbance Vs Wavelength behavior studied. Optical absorbance of 150 nm thin CdS film shows sharp edge at 500 nm and band gap observed is at 2.53 eV.



PROJECT NO	110
TITLE	A comparative study of telecommunication technology: Its impact and relevance on Urban, Rural and Tribal community of Maharashtra
INVESTIGATORS	Dr Prakash B Gambhir, Academic Staff College, UoP
DURATION	2.5 years (Started on: April 2010)
BUDGET (₹)	4,40,000

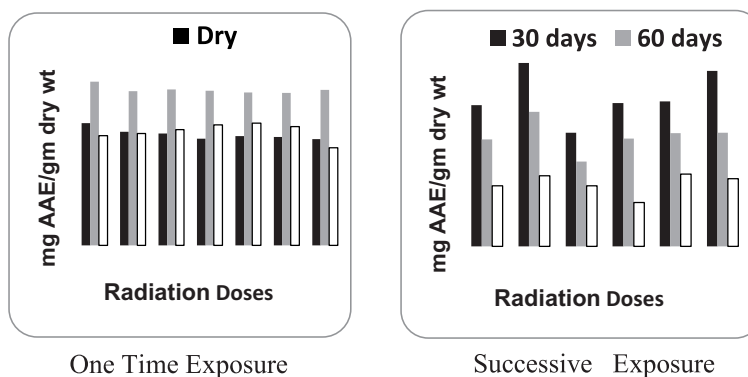
SUMMARY OF FINDINGS

In the present study, an attempt is made to understand and interpret the socioeconomic impacts of mobile phones. The field survey has been conducted and analysis of socioeconomic impacts on urban, rural and tribal subscribers of Maharashtra has been done. It is found that the mobile telephony has brought the social and economical changes leading to developmental activities. But this development is not to the same extent in all these areas. There is relatively lower socioeconomic development in tribal areas. Mobile telephony is found to create new jobs and individual entrepreneurial opportunities. People are utilizing mobile phones irrespective of their gender, caste, and religion in the society. Mobile phones are found to improve the literacy rate, education and health services and thus improving quality of life. However there is disparity in education, income, occupation, access and availability of mobile network etc. This disparity among urban, rural and tribal areas is found to increase rapidly. The study confirms that the mobile network is not fully developed in rural and tribal areas. The telecommunication departments including the private mobile companies are not concentrating in tribal and rural areas due to several constraints. BSNL and a few private companies do provide the communication services to rural and tribal areas, but the facilities, penetration of services and quality of service etc are poor. It is noted that there is a tremendous scope for market for mobile telephony in rural and tribal India. The implementation of ICT in rural and tribal area will help the socio-economic development. Tribal communities are lagging in using mobile technology and are deprived of its full benefits. But the survey indicates their agreement that their social life has changed due to mobile phones. The Government needs to focus on these areas and provide communication technology. There should be special policies for these areas.

PROJECT NO	112
TITLE	Impact of low and high radiation doses on the nutritional quality, functional properties and shelf life of various foods
INVESTIGATORS	Prof Madhurima Dikshit, Dept. of Chemistry, UoP
DURATION	3 years (Started on: April 2010)
BUDGET (₹)	14,91,800

SUMMARY OF FINDINGS

Aim of the study was to investigate the effects of low and high dose γ - rays on the nutritional and eating qualities and the shelf life of selected functional foods. Study included investigation of proximate and phytochemical compositions along with the evaluation of the nutritional and functional potential. Mung and Soybeans were selected with sprouting as preprocessing. Sprouting improves eating quality along with the nutritional and functional properties. Mung sprouts can be consumed in the raw form and hence that was the first choice even though Soybean has higher nutritional potential. Processed products were prepared from Mung sprouts to develop taste and increase acceptability. Other products comprising of cereals, millets and pulses were prepared along with highly phytochemical enriched chutney in place of vegetable. Test results on Mung samples show that 1 kGy is a safe dose level and successive exposure is not damaging compared to one time exposure. Antioxidant potential showed increase up to 60 days exposure and the radical scavenging ability did not decrease. This is due to role of enzymatic antioxidants. In regard to Soybean, samples were irradiated to 3 different doses, one time exposure and then sprouted for 3 days. Exposure to Gamma radiation is found to increase the antioxidant capacity and reducing power of Soybean seeds.



Effect of γ -radiation on Total antioxidant activity (FRAP)

4. Ongoing Research Projects

Presently there are 27 ongoing projects including ten projects sanctioned in January-February 2013. Progress of these projects is monitored through periodical progress reports and reviews by the Preliminary Evaluation Committee (PEC). Investigators are invited to make detailed presentation highlighting the technical milestones in their studies. Midcourse correction is made wherever necessary. In the year 2012-13, PEC chaired by Prof S Ananthkrishnan conducted two review meetings held on 26th July 2012 and 04 March 2013 to assess the progress of the ongoing projects. Current status in respect of ongoing projects (No.104, 105, 107, 109, 111, 113 and 115-125) is given below. Progress of the newly sanctioned Projects(No.126 to No.135) is planned to be reviewed after completion of six months period.

S.No. Project title, Name of, Investigator Project cost & Duration	Current status of the study
<p>1. Application of remotely sensed data for the evaluation of impervious surface growth and its effect on surface runoff in two rapidly urbanizing watersheds of Western Maharashtra, India (Project no.104) Dr (Ms) Anargha Dhorde</p> <p>Budget: Rs 9.66 lakhs Duration: 3 years (Started on: May 2010)</p>	<p>The entire basin was divided into two major basins – Mula-Mutha to the south and Bhima-Indrayani towards North. Surface runoff for the entire area was attempted first. As it was realized that the pattern of surface runoff generated is at a coarse resolution, separate basin as mentioned above were taken up. Further detailing was necessary and hence Sub-basins with main basins were demarcated and surface runoff using the SCS-CN method was computed. Since most of the basins were ungauged, curve numbers were computed for the gauged basins where discharge data was available. In order to ascertain the methods adopted, students t-test along with confidence interval of 1SE were attempted. A sound algorithm for extraction of the percent impervious surface (IS) at pixel level was developed.</p> <p>Status of the project: Study is completed and report is under preparation.</p>
<p>2. Modeling spatial patterns in fresh water reservoirs with special reference to plankton, mollusks and fishes using physicochemical characteristics of water and remote sensing techniques (Project no.105) Dr Pandit Sangeeta V</p> <p>Budget: Rs 13.68 lakhs Duration: 3 years (Started on: April 2010)</p>	<p>A three year study was conducted in two reservoirs, Panshet and Varasgaon to evaluate the changes in water quality parameters, Zooplanktons, Fish diversity Indices and also to use remote sensing and GIS techniques for mapping water quality of the study area. Other parameters such as Spatial Distribution of pH, Electric Conductivity, Total Dissolved Solids, Hardness, Alkalinity, Acidity, Dissolved Oxygen Temperature, Salinity, Phosphate, Nitrate and Sulphate contents in these reservoirs were studied. LISS III sensor data was used to predict SDT of entire reservoir at pixel level i.e., 24 m X 24 m by developing regression equations based on sampling and radiance data from satellite imagery.</p> <p>Status of the project: Study is completed and the report is under preparation.</p>

3. Synthesis and applications of composites of TiO_2 with Carbon nanotubes and metal chalcogenides (Project no.107)
Dr Pragati R Thakur
- Budget: Rs 14.52 lakhs
Duration: 3 years (Started on: April 2010)
- Synthesized nanocomposite was characterized by various techniques. Photocatalytic efficiency of the synthesized TiO_2 -MWCNTs nanocomposite was studied using multilamp photoreactor and mineralization of pollutants was checked by Chemical Oxygen Demand (COD) values. Synthesis of nanoparticles of Sb_2S_3 by wet chemical method under refluxing conditions and TiO_2 - Sb_2S_3 nanocomposite by hydrothermal and mechanical mixing method has been carried out. These materials were characterized using various analytical tools.
- Status of the project:** Study is completed and the report is under preparation.
4. Use of a Geographical Information System to study tuberculosis epidemiology and the factors affecting case detection in a rural population in Pune district, Maharashtra (Project no.109)
Dr Anita Kar
- Budget: Rs 9.61 lakhs
Duration: 2 years (Started on: April 2010)
- Study was carried out in Chakan, a peri-urban area outside the city of Pune, which has a large migrant population as it is a major industrial area. All health care facilities in Chakan were mapped using a Garmin 76CSx hand held device and the data was imported using ArcGIS 10.0. Tuberculosis surveillance was established by requesting all practitioners to provide address, and sputum samples from suspected tuberculosis cases. Sputum was cultured and species confirmation was done from positive cultures using MPB64 verification. All culture positive patients were mapped at their place of residence. Using residential and genotypic data, cluster analysis was done to test for distribution of tuberculosis cases and strain types in the population.
- Status of the project:** Study is completed and the report is under preparation.
5. Study of invertebrate biodiversity of Sawanga Lake region, Dist Amravati, Maharashtra (Project no.111)
Dr Varsha Wankhade
- Budget: Rs 13.18 lakhs
Duration: 3 years (Started on: April 2010)
- Study of freshwater ecosystem, Sawanga Vithoba lake, Dist Amravati Maharashtra has been carried out by assessing physicochemical properties and bacterial diversity of soil/sediments and water of the lake.
- Status of the project:** Study is completed and the report is under preparation
6. Study of the direct radiative forcing of atmospheric aerosols over different environments (Project no.113)
Dr G R Aher
- Budget: Rs 13.64 lakhs
Duration: 3 years (Started on: May 2010)
- During the study period, experimental data of good quality has been obtained at the Nowrosjee Wadia College (NWC), Pune (as nodal centre), IUCAA Girwali Observatory, Mt. Sinhgad and IIG- Alibag Magnetic Observatory. Data on about 400 clear sky, cloudless days has been analyzed to study the various features of atmospheric aerosols.
- Status of the project:** Study is completed and the report is under preparation.

7. Studies on structural, optical and electrical properties of transparent conducting thin film (TCO) (Project no.115)
Dr Arle Ramdas Nivrutti
- Budget: Rs 3.30 lakhs
Duration: 2 years (Started on: August 2011)
- After optimizing the parameters, films were characterized by various characterization techniques. Chemical spray pyrolysis technique has been used for deposition of ZnO, Al:ZnO, SnO₂ and F:SnO₂ thin films for varying concentration of solution, volume of the solution, substrate temperature, substrate to nozzle distance, nozzle diameter, spray rate etc and characteristics of the films have been studied.
Status of the project: Study will be completed as per the schedule.
8. Novel electrochemical approach to prepare CuInGaSe₂ based solar cells using non-aqueous bath (Project no.116)
Dr N B Chaure
- Budget: Rs 12.68 lakhs
Duration: 2 years (Started on: August 2011)
- Deposition and characterization of different window layers (CdS, ZnS, ZnO, ZnO-Al, CdZnS) are completed. Electrodeposition techniques such as sol-gel, spin coating, chemical bath deposition, etc. have been used to deposit window layers. Post deposition annealing was carried out to improve the crystallinity and particle size. CIS and CIGS films annealed in selenium atmosphere are found better in stoichiometry and crystallinity as compared in air. The substrate configuration solar cell with structure ITO / CdS / CIS / Au is developed and tested using SP-150 Biologic potentiostat / galvanostat.
Status of the project: Study is progressing satisfactorily.
9. Design and development of an odor tracking system (Project no.117)
Dr (Mrs) DC Gharpure /
Dr AD Shaligram
- Budget: Rs 10.60 lakhs
Duration: 2 years (Started on: August 2011)
- Experiments for odor mapping for different configuration of gas sensor arrangement have been carried out. The data has been analysed and odor images generated. Hardware implementation using PIC is in progress.
Status of the project: Study is progressing satisfactorily.
10. Study of interferometric data and its applications for subsidence monitoring (Project no.118)
Mrs Chaitali Abhijit Laulkar /
Dr Vijaya Chamundeeswari
- Budget: Rs 6.56 lakhs
Duration: 2 years (Started on: August 2011)
- Framework for implementation of the modules is ready. After testing, same module will be implemented using Hadoop Map /Reduce programming paradigm.
Status of the project: Study is progressing satisfactorily.

11. Identification of critical areas of conservation concern using RS-GIS technique from northern Western Ghats of India (Project no.119)
Dr Ankur Patwardhan
- Budget: Rs 10.87 lakhs
Duration: 2 years (Started on: August 2011)
- During the period, from August 2011 to December 2012, 49 grids were surveyed and ground truth was established. Out of these, 16 grids are located inside core area of Koyna wildlife sanctuary (WLS) and Chandoli national park (NP). In the sampling, 190 woody plant species, 200 avian species and 107 butterfly species were recorded. The field-work is completed and grid-wise thematic maps (such as species richness, diversity, threatscape) are under preparation.
Status of the project: Study is progressing satisfactorily.
12. Development of high performance polycarbonate/graphite nanocomposites with low percolation for EMI shielding application (Project no.120)
Dr Rajendra Kumar Goyal/
Dr (Mrs) R C Aiyer
- Budget: Rs 10.30 lakhs
Duration: 2 years (Started on: August 2011)
- Electrical conductivity and dielectric properties of PC/EG nanocomposites were studied. Another series of composites based on polycarbonate (PC) as matrix and nickel (Ni), cobalt (Co), stainless steel (SS) as fillers were also prepared using solution method followed by hot pressing. The density, electrical conductivity, morphology (OM/SEM) of the samples investigated. The electrical conductivity results showed that these nanocomposites may be useful for the EMI shielding applications.
Status of the project: Study is progressing satisfactorily.
13. Synthesis and characterization of Copper Chromite for propellant (Project no.121)
Dr SL Bonde/
Dr(Mrs) RP Bhadane
- Budget: Rs 8.00 lakhs
Duration: 2 years (Started on: August 2011)
- Synthesis of copper chromite (CuCr_2O_4) in 2.5 gm batch size has been carried out by solution combustion method. Characterization using XRD, SEM techniques has been completed. The particle size of the catalyst is in the range 25nm – 100nm. Some agglomeration is also observed. The efforts are on to avoid this.
Status of the project: Study is progressing satisfactorily.
14. Preparation of ternary oxides like lead zirconium titanate (PZT) with and without dopants and barium titanate - polymer composites for microwave dielectric application (12-15 GHz) (Project no.122)
Dr Manisha YKhaladkar / Dr (Mrs) Rohini P Mudhalwadkar
- Budget: Rs 10.00 lakhs
Duration: 2 years (Started on: August 2011)
- Sintering furnace made fully functional. Synthesis and process parameters optimization for BMT and BZT is completed. DTA of above prepared material by solid state method is done from ambient to 1000°C . XRD of the pure and B_2O_3 added BMT is done and XRD images at various temperatures showed reported hexagonal phase (JCPDS No 8-212). Dielectric studies on 2.5% B_2O_3 added samples are done. BMT pure and with 1%, 2% B_2O_3 and BZT samples are sent to SAC Ahmedabad for dielectric measurements.
Status of the project: Study is progressing satisfactorily.

15. Biodegradation of Ammonium Perchlorate by phytoremediation approaches
(Project no.123)
Dr Rekha Gupta/
Dr Vinay Kumar
- Budget: Rs 10.52 lakhs
Duration: 3 years (Started on: August 2011)
- Results of present study indicate that plants are able to absorb and accumulate perchlorate in their tissues. They are able to tolerate the perchlorate stress, though their growth is affected as compared with the control plants without perchlorate stress. Further it is seen that there is a decrease in total chlorophyll content, root length, shoot length, number of leaves and dry weight compared to control plant. Uptake of perchlorate from water and soil by plants has led to depletion of perchlorate from soil and water where plants are growing. Further experimental work is in progress.
Status of the project: Study will be completed as per the schedule.
16. Enhancing rural development through improved communication: case study western India (Project no.124)
Prof Sanjeev Sonawane/
Smt Geeta Kamble
- Budget: Rs 10.12 lakhs
Duration: 2 years (Started on: August 2011)
- Draft A Tool for data collection is completed and is being discussed with ISRO engineers. Necessary changes will be made after the discussion. Areas for pilot study have been selected.
Status of the project: Study needs to be expedited to meet the project schedule.
17. Measurement of plasma temperature and identification of species during re-entry of Space Shuttle, using plasma emission spectroscopy
(Project no.125)
Dr V L Mathe /
Prof Mrs S V Bhoraskar /
Dr Indrani Banarjee
- Budget: Rs 12.164 lakhs
Duration: 2 years (Started on: August 2011)
- Electron Cyclotron Resonance (ECR) plasma reactor can produce plasma densities of the order of 10^{10} to 10^{13} cm^{-3} which is equivalent to density at around 90 km from the earth surface. Such plasma was generated in ECR plasma reactor and species present were investigated using emission spectra from the gaseous plasma consisting of air, nitrogen, oxygen, hydrogen and argon.
Status of the project: Project is progressing satisfactorily. PI to interact with ISRO scientists to make the study relevant and useful.

5. New Research Projects

Invitation for new research proposals was sent to various departments/affiliated colleges of University of Pune in the month of October-November 2012 for submission of research proposals under ISRO-UoP Joint Research Programme. In response, 54 proposals were received which were scrutinized by the Preliminary Evaluation Committee (PEC) chaired by Prof S Ananthakrishnan. From the list of new proposals, Committee shortlisted 15 proposals based on the following criteria:

- Relevance of research work in the identified areas and ISRO activities/programme
- Novelty/innovation in the proposed research work
- Past performance of the Investigators in regard to their completed/ongoing projects under this scheme

Investigators of these 15 proposals were invited to give technical presentation to PEC in its meeting held on 25 March 2013. After having interaction with the investigators and the experts in the related fields, PEC recommended 9 proposals for the consideration of JPC. Details of each of these proposals explaining objectives of the study, methodology, time period, funds requirement etc were then scheduled for presentation to JPC by the prospective investigators. In addition to the above nine proposals, a study project titled **Feasibility Study on Indigenous Development of Electrochemical Based Gas Sensors and Transmitters** by Prof. A.D. Shaligram was also presented to PEC for its consideration. It was explained that a suggestion had come from SDSC/ISRO to explore the possibility of indigenous development of gas sensor and transmitter system for N_2O_4 and UDMH. A core Committee was constituted by Hon. Vice Chancellor with Prof A D Shaligram as Convenor for preparing a detailed Project Report. The Committee after due deliberations proposed to take up this development work in two phases. This plan was discussed with the SDSC/ISRO team and as a result of this discussion, the above study project, has been recommended for inclusion along with the new proposals for the consideration of JPC.

6. Major Events in the STC Calendar

1. Review of ongoing projects

First review of the year by Preliminary Evaluation Committee (PEC) under the chairmanship of Prof S Ananthkrishnan took place on 26 July 2012. As on that date, there were 20 ongoing projects and Investigators of these projects were invited to make detailed presentation on the status of their projects and bring out the achievements. If there is a delay in completion of the project, Investigators were required to explain the reasons. Second review took place on 4th March 2013. Stress was given on timely completion of the projects and submission of final technical reports. Investigators were also informed that as advised by the Joint Policy Committee (JPC), Executive Summary of the completed projects would be hence forth put in the University website and it is necessary that the Executive Summary truly reflects the work done under the project.

2. Commencement of new projects

After the receipt of Grants-in-aid from DOS, for the year 2012-13, following ten research projects, which were approved in the JPC meeting held on 23/24 February 2012, made a beginning with the release of first installment of funds in the month of January-February 2013. Salient features of these projects along with the objectives of the proposed study are given below:

S.No.	Project title & other details	Objectives
1.	Hazardous Nitrous Oxide gas leakage detection and monitoring system using wireless sensor network (Project no.126) Dr Arunkumar K Walunj / Dr AD Shaligram Budget: Rs 8.06 lakhs Duration: 2 years (Started on: Feb 2013)	Aim is to develop Nitrous Oxide gas leakage detection and monitoring system using Wireless Sensor Network (WSN). Second goal is to prolong the long-term operation of the wireless nodes with the use of an on board semiconductor gas sensor.
2.	Development of conducting Polyaniline-ZnO nanoparticle composite paint coating for corrosion protection (Project no.127) Dr Praveen P Deshpande Budget: Rs 9.50 lakhs Duration: 2 years (Started on:Jan 2013)	Aim is to synthesize and characterize conducting polyanilinonanoZnOparticles composites. Study includes preparation of paints, corrosion studies and Iron loss determination.

3. Impact of flood hazards on human settlement in Pune region (Project no.128)
Dr Vijaya Khairkar
- Aim is to study spatio-temporal distribution of flood in Pune region from 1961 and analyze the impact and intensity of floods on human habitat. Also planned to study use of GIS in disaster management sector.
- Budget: Rs 6.44 lakhs
Duration: 2 years (Started on: Jan 2013)
4. Splitting of carbon dioxide into oxygen and carbon moiety using biomimetics biological catalysts involved in photosynthesis (Project no.129)
Dr (Mrs) Waghmode Shobha
- Project aims at synthesis & characterisation of biomimetics of photosynthesis and study mechanism in carbon dioxide splitting using Biomimetics.
- Budget: Rs 9.13 lakhs
Duration: 2 years (Started on: Jan 2013)
5. Development of transition metal oxide nanoparticle films for solar radiation protection and solar cells (Project no.130)
Dr Jayashree Pant
- Aim is to synthesize nanoparticles of transition metal-oxides and make good quality films. The films will be tested for their ability to absorb UV radiations and to obtain the range of band gap energies for solar cells.
- Budget: Rs 10.00 lakhs
Duration: 2 years (Started on: Jan. 2013)
6. Preparation of Co_3O_4 films by using electrochemical and spray pyrolysis deposition methods for gas sensing applications (Project no.131)
Dr Shelke Pandit Nivrattirao
- Plan is to develop electrochemical deposition and spray pyrolysis deposition system to prepare highly adhesive Co_3O_4 films on different substrates. Study includes characterization and temperature dependent gas sensing/characterization system.
- Budget: Rs 14.25 lakhs
Duration: 2 years (Started on: Jan 2013)
7. Real time human detection using covariance matrix as human descriptor (Project no.132)
Mrs SA Kakade
- Aim is to implement robust method to detect human if present in video under dynamic environment. Study includes developing softwares to monitor movement or motion in a localized area and on detecting motion checks for object whether it is human or nonhuman.
- Budget: Rs 4.00 lakhs
Duration: 2 years (Started on: Jan 2013)

8. Metallic surface Plasmon phenomenon as a biosensor for the identification of biomolecules
(Project no.133)
Dr V M Harpale
- Budget: Rs 18.50 lakhs
Duration: 2 years (Started on: Jan 2013)
9. Sensor-less XY planar flexural scanning mechanism for precision applications
(Project no.134)
Dr Suhas Deshmukh
- Budget: Rs 14.32 lakhs
Duration: 2 years (Started on: Jan 2013)
10. Digital Elevation Model (DEM) fusion
(Project no.135)
Dr Pratibha Shingare
- Budget: Rs 11.54 lakhs
Duration: 2 years (Started on: Jan 2013)
- Project aims at developing SERS Spectroscopy as an analytical tool for characterization of biomolecules. Study includes monitoring airborne samples for biological species such as pollen, bacteria, viruses etc and to identify the fingerprints vibrational spectral data of various biological species.
- Study involves design, development, identification, control and demonstration of XY flexural Mechanism for its high speed (i.e. upto 5-6 mm/s), large range (scan range of 10-15 mm), and precision positioning (less than micron i.e. submicron positioning).
- Aim is to automatically generate geometrically accurate new DEM surface by depicting the correct height information of the area, clean by eliminating blunders (spikes, holes etc.) and errors present in the initial data and complete by modeling all the area in the highest possible resolution.

7. ISRO Proposal Format

Faculty Members of University of Pune and its affiliated colleges are required to follow the ISRO format as given in <http://www.isro.gov.in/scripts/srrespond.aspx> and reproduced below for making research proposals and seeking financial grant from ISRO. Requirement is that Principal Investigator(s) should be full-time employee(s) of the concerned institution and proposal is to be forwarded through Head of the academic institution. Research proposals from individuals not affiliated to any recognized institution of the University are not considered. Institutions proposing a project for support are expected to commit the use of the existing infrastructure available with them. ISRO provides financial grants to support fellowship, materials, consumables, internal travel, testing charges, data etc. Funds for purchase of essential minor equipments which are not available in the institution and would be useful for future projects are also provided. There is no provision for any kind of payment to the Principal Investigator (or other staff) belonging to the Institution. The allocated funds cannot be used for travel abroad for any reasons. Generally invitation for making research proposals is sent in the month of September-October and processing of the proposals is completed in 4-5 months time. For any information/clarification, Faculty Members may contact the ISRO-UoP Space Technology Cell or visit our website www.unipune.ac.in/isro to get the required information.

Application for grant of funds

1. Application Institution
2. Title of the Research Proposal
3. Name of the Principal Investigator
4. Name(s) of other investigator(s) with the name(s) of their Institution
5. Proposed duration of Research Project
6. Amount of grant requested (in ₹)

	1st Year	2nd Year	Total
Staff			
Equipment and Supplies			
Others			
Total			

7.
 - a) Bio-data of all the Investigators (Format-A).
 - b) Brief description of the Research Proposal with details of budget (Format-B).
 - c) Declaration (Format-C).
8. I/We have carefully read the terms and conditions for ISRO Research Grants and agree to abide by them. It is certified that if the research proposal is approved for financial support by ISRO, all basic facilities including administrative support available at our Institution and needed to execute the project will be extended to the Principal Investigator and other Investigators.

	Name	Institution	Designation
Principal Investigator			
Co-Investigator(s)			
Head of the Department/Area			
Head of the Institution			

Format A**Bio-data of the Investigator(s)***

1. Name
2. Date of Birth (dd/mm/yyyy)
3. Designation
4. Degrees conferred (begin with Bachelor's degree)

Degree	Institution conferring the degree	Field(s)	Year
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5. Research/training experience (in chronological order)

Duration	Institution	Name of work done
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6. Major scientific fields of Interest
7. List of publications
8. Email id and Telephone number of PI
9. Email id of the Head of the academic institution

* Bio-data for all the investigators should be given, each on a separate sheet.

Format B**Proposal Preparation Format****1. Title of the research proposal****2. Summary of the proposed research**

A simple concise statement about investigation, its conduct and anticipated results in no more than 200 words

3. Objectives

A brief definition of the objectives and their scientific, technical and techno- economic importance

4. Major scientific fields of interest

A brief history and basis for the proposal and a demonstration of the need for such an investigation preferably with reference to the possible application of the results to ISRO's activities. A reference should also be made to the latest work being carried out in the field and the present state-of-art of the subject.

5. Approach

A clear description of the concepts to be used in the investigation should be given. Details of the method and procedures for carrying out the investigation with necessary instrumentation and expected time schedules should be included. All supporting studies necessary for the investigation should be identified. Necessary information of any collaborative arrangement, if existing with other investigators for such studies, should be furnished. The Principal Investigator is expected to have worked out his collaborative arrangement himself. For the development of balloon, rocket and satellite-borne payloads it will be necessary to provide relevant details of their design. ISRO should also be informed whether the Institution has adequate facilities for such payload development or will be dependent on ISRO or some other Institution for this purpose.

6. Data reduction and analysis

A brief description of the data reduction and analysis plan should be included. If any assistance is required from ISRO for data reduction purposes, it should be indicated clearly.

7. Available Institutional facilities

Facilities such as equipments, test instruments etc available at the parent Institution for the proposed investigation should be listed.

8. Fund Requirement

Detailed year wise break-up for the Project budget should be given as follows

	1 st Year	2 nd Year	Total
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8.1 Salaries:8.1.1 Research Fellows/
Project Assistant

8.1.2 Supporting Technical Staff

8.1.3 Other staff, if any

Total:

(Note: please specify designation and rate of salary per month for each category)

8.2 Equipment

	1 st Year	2 nd Year	Total
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Total:

(Note: Please specify various individual items of equipment and indicate foreign exchange requirement, if any)

8.3 Consumables and Supplies

	1 st Year	2 nd Year	Total
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Total:

(Note: Please specify the items and indicate foreign exchange requirement, if any.)

8.4 Travel

	1 st Year	2 nd Year	Total
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Total:**8.5 Other project costs, if any (give details)**

	1 st Year	2 nd Year	Total
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a. Grand Total

9. Whether the same or similar proposal has been submitted to other funding agencies of Government of India. If yes, please provide details of the Institution & status of the proposal.

Format C

Declaration

I/We hereby agree to abide by the rules and regulations of ISRO research grants and accept to be governed by all the terms and conditions laid down for this purpose.

I/We certify that I/We have not received any grant-in-aid for the same purpose from any other department of the central government/state government/public sector enterprise during the period to which the grant relates.

Name

Designation

Signature

Principal Investigator
Head of the Department/Area
Head of the Institution

Seal of the Head of the Institution

8. Suggested Topics for Research Proposals

Keeping ISRO's space programme in mind, following list of research topics has been prepared for the consideration of prospective Investigators from Pune University while making research proposals under the above scheme:

Atmospheric / Oceanic science area

1. Study projects to establish observation network and create remote sensing based spatial databases for modeling and periodic assessment of net carbon balance in India
2. Dynamic modeling for real time weather forecast
3. Assimilation of satellite data in numerical weather and ocean prediction models
4. Global and regional numerical dynamic models for ocean state forecast
5. Diagnostic study using satellite data to understand atmospheric and oceanic process near ocean surface
6. Empirical and dynamic modeling and assimilation techniques for predicting movement and intensity of a cyclone
7. Aerosols and their impact on climate, algorithms for atmospheric aerosols using satellite information over land and oceans
8. Aerosol transportation and climatic studies
9. Estimating aerosols over land and ocean using multiangular and polarization measurements
10. Algorithms/models for generating 5-daily and 10-daily snow cover products, snow melt run-off, features of glaciers to understand Himalayan cryosphere
11. Atmospheric dynamics – winds, waves and structure
12. Atmospheric modeling for radiometric correction
13. Wind vectors from satellite observations
14. Cloud studies using satellite data
15. Physics and dynamics of atmospheric boundary layer (0-1km)
16. Ionospheric (100-1000 km) modeling characteristics, features, dynamics, electron content
17. Propagation studies for ionospheric correction making use of satcom technology
18. Temperature and humidity profile from atmospheric sounders
19. Application of atmospheric parameters in monsoon related activities
20. Rainfall estimates from infrared and microwave radiometers
21. Retrieval of ocean surface wind vector from first principle
22. Retrieval of ocean wave spectra and ocean winds from Synthetic Aperture Radar
23. Simulation of altimeter signals from ocean surface and retrieval of basic ocean parameters
24. Simulation of coastal wave and circulation through Numerical Model
25. Merging open ocean and coastal models for waves and circulations
26. Sensitivity studies on forecast winds, waves, mixed layer depth for their application in physical and biological oceanography
27. Studies related to:
 - ARFI : Aerosol radiative forcing over India (National Network with 40 Universities and Institutions)
 - IGBP : ISRO Geosphere biosphere programme
 - GAGAN – Aircraft navigation

Optical coatings and sensors

1. Piezoelectric films on Zn-cut Al_2O_3 , NCD substrates for Surface Acoustic Wave (SAW) devices with low propagation loss, high performance and high frequency characteristics
2. Langasite single crystal (LGS) for high performance, low loss narrow band SAW filters
3. Nanostructured magnetostrictive thin films for SAW device applications
4. Ferroelectric thin films for electronically tunable filters used in wireless communication system
5. Investigating compaction, focusing, alignment techniques and swath improvement in Hyper spectral system
6. Mathematical modeling and optical domain processing in multipurpose large area array detectors
7. Life/failure mechanism in photo detectors using InGaAs, InSb and Si-PIN technologies and modeling to estimate life of such detectors

Rural development & developmental communication

1. Harnessing space technology for social benefits such as distance education, rural development, tele-medicine, satellite navigation and communication support for disaster management
2. Mapping information and communication practices in the tribal areas, special focus to Rajasthan, Madhya Pradesh, Gujarat and Maharashtra
3. A comparative study on media habits between rural and urban India
4. Community's felt and perceived information needs in the agriculture sector
5. Community's felt and perceived information needs in the health sector of rural India
6. Impact assessment of Edusat Network as supportive role in the field of formal education and teacher's training
7. Socio-economic research/evaluation of satellite-based societal applications
8. Demonstration projects for new applications of space and related technologies for end-users of socio-technical system
9. Study of social, economic and cultural impact of new technologies and production of software as models/examples
10. Content generation in terms of multi-media programs and evaluation study at national and regional levels for Edusat utilization
11. Interactive programs for applications like Training, Education, e-Governance, Disaster Management, Tele-conferencing, Urban/Rural Development under Gramsatprogramme
12. ISRO's Village Resource Centres into multi-service centres and integration with existing VRCs
13. Innovative applications for Education, Health and rural welfare using satcom technology

Geo-informatics

1. Algorithms and techniques for processing terrestrial imagery acquired in stereo/mono
2. Study of planetary geodesy for optimization in calculating surface measurements (coordinates, distances, areas) on spheres or spheroids
3. Methods to analyze multisensor satellite data and to detect guides for mineral exploration
4. Three dimensional models of urban area using GIS techniques
5. Continuous simulation model using high resolution satellite data embedded with GIS technique to represent the entire hydrological system on computer
6. Multi facet model for assessing the impact of a geo-hazard on human settlement and simulating the damage scenario
7. Spatial decision support system (SDSS) for flood management, using Geoinformatics (mathematical and statistical modeling techniques)

Remote sensing applications

1. Investigation in geo-correction models namely (a) Model based on ephemeris platform and sensor information (b) Model relating ground control points or features and (c) Hybrid model
2. Sensor calibration on ground based test sites
3. Signal processing and tracker algorithms for altimeter sensor, correlation algorithm for synthetic aperture radiometer and performance analysis, feature extraction algorithm for microwave data
4. Partitioning land surface temperature into components using angular thermal remote sensing
5. Quantifying variability of green-house gases (GHG) using space borne sensors
6. Agro-ecosystem models to study long term sustainability
7. Developing land data assimilation system to optimally merge remote sensing observations with hydrological model
8. Earthquake precursors using satellite data such as land surface temperature and gravity anomalies
9. Modeling the dynamics of change of land use cover for future projection
10. Modeling hydrological cycle of natural wetlands in relation to change in land use/cover
11. Differential SAR interferometry and its applications for geohazards monitoring
12. Differences in spectral reflectance between healthy and stressed vegetation and fluorescence signal emanating for different crops
13. Hydrological analysis using temporal water level data and field data of irrigation water for different crops especially in arid and semi-arid regions
14. Satellite based mapping and modeling photosynthesis to quantify the biophysical characteristics of mangrove and to predict the effect of climate change on it
15. Developing hyperspectral remote sensing techniques for coral reef mapping and modeling
16. Wetland mapping involving microwave and optical data and modeling Methane emission from Wetlands
17. Integrated approach (including remote sensing inputs) for multi-crop assessment in sparse cropped regions
18. Remote sensing techniques for crop assessment in hilly terrain/high altitudes
19. Remote sensing based indices/techniques for agro-ecosystems characterization
20. Ingestion of remote sensing inputs/products in climate change analysis/modeling of agro-ecosystems
21. Algorithm development for agro-ecosystems product generation from geostationary platform
22. Newer tools and techniques for quick assessment of temporal dynamics of crops/vegetations using Indian multi temporal satellite data
23. Mathematical/matching algorithm in spectral library development using hyper spectral data
24. Modeling soil carbon sequestration in relation to cropping systems and climate change
25. Farming systems model with remote sensing inputs/products
26. Classification of hyper spectral remote sensing data to discriminate between crop condition, variety and stage
27. Inversion of radiative transfer model for estimation of crop parameters from hyper spectral data
28. Marine resources related studies:
 - Calibration and validation
 - Mixed layer physics
 - Algal-bloom specific algorithm for chlorophyll retrieval from ocean colour data
 - Identification of phytoplankton functional type (PFT) and time series measurements on inherent optical properties to develop bio optical algorithm
 - Assessment of fate of carbon during algal bloom
 - Impact of climate change on ocean productivity

29. Environment related studies:
 - Eco-casting of environmental parameters
 - Quantitative modeling of wind erosion
 - Decertification vulnerability analysis
 - Quantitative estimation of gas emission from biomass burning
 - Urban hazard model
 - Microwave scattering and emissivity models from natural surfaces
 - Retrieval and modeling of atmospheric pollutants
 - Hyper spectral data evaluation for forest condition assessment
 - Early warning/forecasting models for land slides
 - Forewarning and damage assessment for natural disasters
 - Development of indices for urban transportation geometry
 - Development of semi automated procedures for urban structural planning
 - Evaluating impact of watershed treatment
 - Web based solution for multi resolution image fusion
 - Methodology to derive digital terrain model
 - Development of web based services
 - Development of data mining tools
30. Disaster management related studies:
 - Early warning for cyclone prediction of track and probable landfall point
 - Areas likely to be inundated and estimation of population affected in case of floods
 - Short range and medium range forecast for local severe weather conditions
 - Earth-quake precursors with satellite based observations and ground experiments
 - System study on services for rural centers, fishing community etc
31. Marine biology
 - Techniques to retrieve gravity/geoid using satellite altimetry over oceans
 - Modeling marine lithosphere using gravity and other geophysical data
 - Subsurface tectonics and associated processes
 - Tsunami modeling
 - Hydrocarbon exploration in offshore regions
 - GIS based marine living resource management system, species specific fisheries forecast, conservation for engendered marine organism
32. Coastal Processes
 - Holocene and Quaternary coastal evolution
 - Coastal erosion and predicting shoreline changes
 - Sediment budgeting with reference to sediment cells
 - Coastal vulnerability models and risk assessment
 - Models for integrated coastal zone management plans
 - Algorithms for Indian coastal waters, atmospheric correction models for turbid water and Bathymetry estimation in optically shallow waters
 - Bio-geo-chemistry of the coastal, components of carbon cycle, nitrogen cycle and phytoplankton blooms, fish stock assessment, primary and new production modeling
33. Geo-Hazards
 - Earthquake precursors
 - Modeling geodynamics
 - Modeling geohazards in particular to urban areas
 - Early warning of landslides
 - Risk modeling due to storm surges/tsunami

34. Geo-Archaeology
 - Multisensor satellite data for identifying hitherto unknown surface/buried archaeological site
 - Validation using geophysical techniques such as GPR, pitting and trenching
35. Mineral exploration
 - Multisensory satellite data for mineral exploration
 - GIS based models to identify mineral prognostics zones by integrating geological, geophysical and geochemical data
36. Planetary Sciences
 - Lunar surface composition, morphology, hyperspectral data analysis, thermal remote sensing, spectral characterization, surface dating and volcanism
 - Lunar gravity and crustal thicknesses studies
 - Martian surface and polar ice
 - Characterization of martian analogues rocks in India
 - Hyperspectral analysis of Mars data, thermal remote sensing of martian atmosphere
 - Studies related to planetary atmosphere and inner and outer planets

Material Sciences - Chemistry/Chemical technology areas

1. H₂O₂ of 98% purity, stabilizers for its safe storage and catalyst for its decomposition
2. Synthesizing cubane and substituted cubanes
3. Making aqueous solution of Hydroxylammonium nitrate (HAN) of 60% concentration and developing catalyst to initiate its decomposition
4. Development of silicone polymers for thermal paints
5. Studies related to fuel cells such as simulation & analysis of humidification methods in microgravity environment

Material Sciences - Mechanical area

1. Modeling guided wave propagation in (i) circumferential direction of tubes and (ii) sheets with defects, to select mode for cross sectional defect detection
2. Modeling eddy current flow in Al sheets for mathematical correlation between eddy current flow and the material property
3. Experimental analysis and evaluation of formability limit diagram for Inconel-718 sheets of different thicknesses (0.5 mm to 1.8 mm)
4. Thermal analysis of resistance spot welds
5. Analysis of weld bead instability in the overlap zone of keyhole electron beam welds
6. Thermal analysis of partial penetration and full penetration seam welds by laser
7. Testing/screening of metallic materials at high temperatures and in high oxygen environment
8. Miniature specimen test techniques
9. Thermal analysis of seam welds by laser
10. Diffusion bonded ceramic-ceramic/metal joints
11. Piezoelectric actuators for position control applications

Material Sciences - Structures area

1. Acoustic Emission technique to detect generation and growth of active defect during flight of launch vehicles
2. AE monitoring with Neural Network for real time integrity evaluation of the hardware
3. Filtering out noise from genuine AE signature

4. Real time monitoring of Electron Beam welding process using AE technique
5. Automated/semi-automated method for strain measurement
6. Measurement of non-uniform residual stresses
7. Digital holographic microscope for MEMS characterization
8. Experimental investigation of delamination fracture toughness
9. Interlaminar shear stress between the skin and honeycomb core
10. PUF Embedded sandwich panels
11. Sandwich structures with negative Poisson's ratio
12. Applicable eccentricity and failure strength of single and multi row lap joint
13. Finite element software for inflatable structures
14. 3-D contact element with friction
15. Microgravity slosh analysis
16. Health monitoring of structures using vibration data
17. Shock and vibration isolation system
18. Structural analysis of solid propellant grains in presence of voids
19. Constitutive equations for nano composites
20. Structural health monitoring through classification of strain patterns
21. Structural health monitoring of composite structures using optical fibres with Bragg Grating sensors

Material Sciences - Aeronautics/aerodynamics/aerothermal areas

1. Estimation of gaseous radiation for interplanetary missions when entry velocity is greater than 15 km/s. Both equilibrium and non-equilibrium air radiation need to be modeled for the estimation of radiative heating.
2. Thermal response of sandwich honeycomb panels under transient heating conditions. Aim is to develop an analytical model to evaluate effective thermal conductivity considering all the modes of heat transfer and to validate the model using controlled experiments.
3. Heat flux distribution in the vicinity of protrusions on the cone cylinder body under varying mach number and Reynolds number. Aim is to develop the methodology and substantiate it by carrying out experiments to get confidence in using the model for configurations with protrusions on cone cylinder body.

Material Sciences - Human Space Flight Programme

1. System supporting LiOH particles on porous ceramic material to absorb carbon dioxide produced by human metabolism
2. Block copolymer based on polyethylene oxide (PEO) soft segment and polyether-ester block amide (PEBA) hard segment to make liquid cooling & ventilation garment (LCVG) for space suit
3. High pressure Oxygen compatible materials
4. Fluid circuit for thermal control system inside crew module
5. Dynamic modeling and analysis of human body exposed to vibration environment during space flight

Electronics/Instrumentation area

1. Low power circuit design techniques for ultra low power RF transreceiver
2. Temperature dependent models of basic devices for design circuits optimized for cryogenic temperatures
3. Nonlinear device modeling for RF and microwave power amplifiers for communication transmitters
4. Input filter with low mass and volume by inductor and capacitor values enhancement techniques
5. Input filter combining accuracy of EM solver and the speed of Equivalent

6. Microwave photonics terminals for free space optical link design, simulation and analysis
7. Low power S-band transceiver (all analog) with inbuilt synthesizer
8. Carrier cancellation techniques with focus on digital signal processing
9. Spectrum sensing techniques like Cognitive Radio (CR) for effective resource utilization
10. Compressive sensing techniques for broadband data communication
11. Doppler compensated modems with higher order coding
12. Fiber optic sensor system for simultaneous measurement of strain, temperature, pressure, and displacement
13. Non-contact whole field strain mapping using principles of stereovision and Digital Image Correlation (DIC)
14. Sensor system and data acquisition for strain measurement at temperatures 800 °C & above
15. Characterizing micro and nano electro mechanical systems under static and dynamic conditions
16. Extending exact synthesis method to non-linear microwave circuit designs
17. Non-linear stability analysis for MMIC design
18. Automated AE monitoring with Neural Network for real time integrity evaluation
19. Differentiating genuine AE signals from external noise in real time AE monitoring
20. Piezoelectric material in precision position control of mirrors in optical structures of satellites
21. Piezo stack actuators and Macro Fiber Composite
22. MEMS based transducers and sensors
23. Cryo temperature sensors

Image processing

1. A generic model based on Rational Polynomial Coefficient (RPC) is a common approach in satellite data processing in encapsulating the interior and exterior orientation of image acquisition, geometric correction and derivation of digital elevation models (DEM). Investigation related to various orders of polynomials, functional representations, bundle adjustment of a block of images using such representations, DEM generation for a block of imagery and extension of this methodology to planetary data processing to be carried out.
2. Currently satellite images have resolution ranging from 25 m to 0.8 m and likely to improve to 0.25 m. Study to be carried out to generate images with better than 0.25 m resolution using available multi-resolution images. This involves development of concepts like super resolution, image registration, sub-pixel processing and multi-resolution.
3. With the availability of high resolution stereo imagery, there is a need to develop new techniques for a dense set of match point pairs from such data to derive the DEM. In view of large volume of data involved, optimization aspect is to be investigated. New algorithms should remove the shortcomings of cross-correlation techniques using FFTs.
4. Urban DEM poses a different challenge due to singular nature of the underlying DEM surface which is to be detected. It should cater to identification of buildings and steep landscapes and determination of their heights through space intersection by other means. Special techniques based on morphological features and AI paradigms to be developed for solving this problem. Generation of relative DEM also to be investigated.
5. Developing robust techniques using image cues for interpolation from DEMs and considering constraints such as break points, break lines and exclusion masks
6. Combining DEMs from various sources into a single DEM considering slope, aspect and other terrain properties for better DEMs



PEC Members in a discussion



Project status presentation during 14th PEC Meeting

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