

## REORGANISATION OF IIRS AS INDEPENDENT UNIT OF ISRO

Indian Institute of Remote Sensing, Dehradun has been premier institute responsible for capacity building in the field of Remote Sensing and GIS applications through education and training programmes at postgraduate level. Formerly known as Indian Photo-Interpretation Institute (IPI), the Institute was founded on 21st April 1966 under the aegis of Survey of India (SOI). It was established with the collaboration of the Government of The Netherlands on the pattern of International Institute for Geo-information Science and Earth Observation (ITC), formerly known as International Institute for Aerospace Survey and Earth Sciences, The Netherlands. The original idea of setting the Institute came from India's first Prime Minister Pandit Jawahar Lal Nehru during his visit to The Netherlands in 1957. The Institute boasts to be the first of its kind in entire South-East Asia. IPI was merged with National Remote Sensing Agency (NRSA) in July 1976 (also under DST) and in the year 1980, NRSA came under the umbrella of Department of Space (Government of India). The shift from photo-interpretation to remote sensing was reinforced by renaming IPI as IIRS in 1983. The Government converted NRSA into a Government Entity to be called as National Remote Sensing Centre, a Centre under DOS/ISRO with effect from September 1, 2008.

Realizing the potential of Earth Observation System and ISRO's forthcoming initiatives in the areas of Natural Resource Survey, Earth and Atmospheric Sciences and Oceanography, Chairman ISRO has reorganized IIRS as a separate entity of ISRO w.e.f. April 30th, 2011. IIRS will continue its Training, Education and Research programmes with enhanced focus on Microwave Remote Sensing, Hyperspectral Remote Sensing and Climate studies.

The institute will be guided by a Management Council which will provide overall direction for the development of the institute. Dr. P.S. Roy, Outstanding Scientist has been appointed as first Director of IIRS w.e.f April 30th, 2011

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## COURSE CALENDAR 2012

## SPECIAL COURSES FOR OFFICIALS FROM SURVEY OF INDIA

Providing reliable and accurate information with necessary details on time is extremely important for geospatial solutions in the areas of rural & social development, infrastructure and natural resources management programmes. Presently India has topographic and thematic maps on 1: 50,000 and 1: 250,000 scale and in some selected areas covering about 60% of the country, the topographic maps are available on 1: 25,000. Keeping this constraint in mind, it is a prerequisite to generate large scale base maps for use in decision making and developmental programmes.

Department of Science and Technology has constituted a task force, which recommended methodology to prepare 1: 10,000 scale thematic maps with limited cartographic information on Indian Dataset. It was observed that Cartosat-1

and LISS IV merged images could be good source for generation of 10K thematic maps for the entire country.

In India, SOI/DST is national nodal organization for generation of topographic maps and will therefore be responsible for generating 10K maps for the entire country. With this background tailor made programmes for personnel at the operator and supervisory level were organised.

The first course titled “Large Scale mapping using Satellite Images” was designed for operator level people and included Remote Sensing Data acquisition, Visual Information Extraction, Information Extraction from high resolution satellite images, satellite Photogrammetry, 2D and 3D feature extraction, Digital Image processing and basics of Geographic Information System. A total number of 100 officer trainees have been trained in three batches.

The Second course titled “Large Scale Mapping Using Satellite Images with special emphasis on Image Quality and Evaluation Process” was specifically designed for supervisory level people and included Introductory Remote Sensing, Georeferencing of high resolution satellite images, Orthorectification of satellite images, Image Fusion, Image mosaicking, Image Quality assessment and map quality assessment as major topics. A total number of 20 officer trainees have been trained so far in this course in two batches.

**Poonam S. Tiwari and Heena Pande**



Survey of India officer trainees with IIRS faculty

## COMPULSORY ORIENTATION COURSE FOR INDIAN FOREST SERVICE OFFICERS

The Forestry and Ecology Division organized a special Ministry of Environment and Forests (MoEF) - sponsored Compulsory Orientation Course for Indian Forest Service Officers from 8th to 12th August, 2011 at IIRS. Such courses are normally awarded to the centres of excellence in remote sensing and GIS and this was the seventh such course organized by the Division for senior IFS officers. A total of twenty one officers joined the course. They came from various states viz., Madhya Pradesh (5), Maharashtra (2), Gujarat (2), Andhra Pradesh (2), Jharkhand (1), Punjab (1), Himachal Pradesh (1), Uttar Pradesh (1), Odisha (1), Chhattisgarh (1) and Rajasthan (1). One officer each was from Regional Office of MoEF at Bhopal, Forest Survey of India Regional Office at Shimla and Indian Council of Forestry Research and Education’s Rain Forest Research Institute at Jorhat in Assam.

The lectures and practical covered major working areas of the forest officers and were approved by MoEF. They included basic of remote sensing, GIS and GPS, spectral properties of vegetation, visual and digital image interpretation, forest change detection, growing stock assessment, working plan preparation, biodiversity characterization at landscape level, wildlife habitat modelling, forest fire risk modeling, and open source remote sensing and GIS software. Two guest lectures on role of remote sensing and GIS in environment impact assessment by Dr. V.B. Mathur, Dean, Faculty of Wildlife Science, Wildlife Institute of India, and forest cover monitoring in India by Mr. M.L. Srivastav, Joint Director, Forest Survey of India were also organized for the benefit of the course participants. The participants conveyed that the lecture and practical topics were of direct relevance to their day-to-day working. A DVD with currently available open-source DIP and

GIS software was provided to the course participants.

A half-day field visit to Lachchhiwala Range Forest. The Assistant Conservator of Forests and Range Forest Officer of the Lachchhiwala Range joined the team during field work. The participants felt that field work was very enlightening for them to understand and correlate the image elements with the

forests in the field. The officers were very happy with the lodging and boarding arrangements and gave excellent feedback for forwarding the same to MoEF, New Delhi. Several expressed that such a course should be of longer duration.

**S.P.S. Kushwaha,**

## SPECIAL SHORT COURSE FOR SOUTH CENTRAL RAILWAY (SCR)

A Special short course on "Remote Sensing and GIS applications for Hydrological studies - With special emphasis to assessment of Catchment Area/Discharge using Digital Elevation Model" was organized for Officers of South Central Railway (SCR) - Secunderabad, from 23 August -03 September 2011 at Water Resources Division, IIRS. Total 10 officers joined for this special training course. The various topics covered were, basics of Remote Sensing (RS) and Geographic Information System (GIS), visual and digital image processing, spatial data analysis, GPS/DGPS, RS-GIS applications for water resources, catchment hydrology and quantification of hydrological elements through RS data and GIS, basics concepts of Digital Elevation Model (DEM), DEM creation

using RS-GIS, DEM applications in catchment area delineation and its drainage extraction, rainfall runoff modelling (design storm based rational method), Geo HMS for catchment data base creation and Hydrological Modelling System (HMS) for hydrological modelling, Geo RAS for river geo data base creation and River Analyses System (RAS) for river design flood flow modelling and culvert/bridge design at railway bridge site.

The course participants were given hands on experience in the form of practical exercises namely, visual and digital image processing, rainfall Interpolation and DEM analysis in GIS, rainfall-runoff modeling, design storm based rational method for flood peak using RS and GIS, catchment geo data creation in Geo HMS (catchment area, drainage length, catchment centroid, longest flow length, centroidal flow length, river and catchment slope etc.), & design flow estimation using HMS, river flow modelling using RAS. Demonstrations on use of DGPS for ground truth collection at IIRS campus, field surveys with RS images and GPS at railway bridge site near Haridwar and Mussoorie catchment area were also conducted.

The lecture notes, practical handouts and reference materials were provided to course participants in both hard as well as soft format. Knowledge gained in the course will benefit the course participants in various catchment area/discharge estimation studies for railway bridge sites as well as aid in decision making process.

**Praveen K. Thakur and S.P. Aggarwal**



## REMOTE SENSING: AN OVERVIEW OF DECISION MAKERS

A course on "Remote Sensing: An Overview of Decision Makers" is organized every year at Indian Institute of Remote Sensing for senior level officials who are involved in decision making in their respective departments. This year the course was organized from 14th to 17th June, 2011. Total 17 senior officials from 14 departments from all over country, namely Chennai Metropolitan Water Supply and Sewerage Board Chennai, Karnataka State Council for

Science and Technology, Bangalore, M.P. Council of Science & Technology, Bhopal, Kolkata Port Trust, Kolkata, DIPAC, Ministry of Defense, New Delhi, G.B Pant Institute of Himalayan Environmental & Development, Almora, Tamil Nadu Forest Department, Chennai, Ministry of Environment of Forests, Eastern Regional Office Bhubaneswar, Karnataka Town and Country Planning Department, NIC-UP State Unit, Lucknow, WRDO, Bangalore, Karnataka, PACT, UPWSR,



U.P. , Irrigation Department, Lucknow, Andhara Pradesh Housing Board, Hyderabad, National Capital Region Planning Board, Delhi joined the course.

The course was organized such that first day was devoted to Overview of RS & GIS Technology. On second day, emphasis was given on Geological disaster monitoring and Management. Theme specific exposure on remote sensing application in Agriculture & Soil, Forestry & Ecology, Geosciences, Human Settlement Analysis, Marine & Atmosphere Sciences, Water Resources, were arranged for all participants separately as per their discipline and interest. On third day participants were given exposure on Current trends in Remote Sensing & Geospatial technology, Satellite communication for disaster management. Field excursion to



Mussoorie was organized in the afternoon session. Last day was devoted on Space based information support and Decentralized Planning & Rural Development. For the benefit of the participants few specialized guest lecturers were organized. These lectures were delivered by senior guest faculty from NRSC & IIT which includes Dr. G. Behera, Deputy Director (RS & GIS AA) & Prof. K. Bandyopadhyay, IIT, Kharagpur.

At the end valedictory function was organized and feedback is taken from the course participants. In his valedictory address Dr. P.S. Roy, Director, IIRS emphasized the importance of such type of courses for Decision Makers and commitment of IIRS, towards capacity building among user departments.

**Dr. S. P. Aggarwal**

## INTERNATIONAL TRAINING COURSE ON MICROWAVE REMOTE SENSING AND ITS APPLICATIONS

A short course on Microwave Remote Sensing and its Applications, was conducted at Indian Institute of Remote Sensing, Dehradun from 4<sup>th</sup> – 29<sup>th</sup> April, 2011. 26 professional attended, from 16 countries in Asia Pacific Region namely Bangladesh, China, India, Iran, Indonesia, Kyrgyzstan, Kazakhstan, Malaysia, Mongolia, Phillipines Nepal, Sri Lanka, Tajikistan, Thailand, Uzbekistan, and Vietnam participated in the course.

The objective of this training course was to provide awareness about the concept of Microwave Remote Sensing, aspects of data processing, potential of microwave data applications through various case studies for developing capacity in practical use of microwave remote sensing data in disaster management and natural resources inventory and monitoring.

The course was designed in a modular structure and provided a blend of theory, and practical experience.

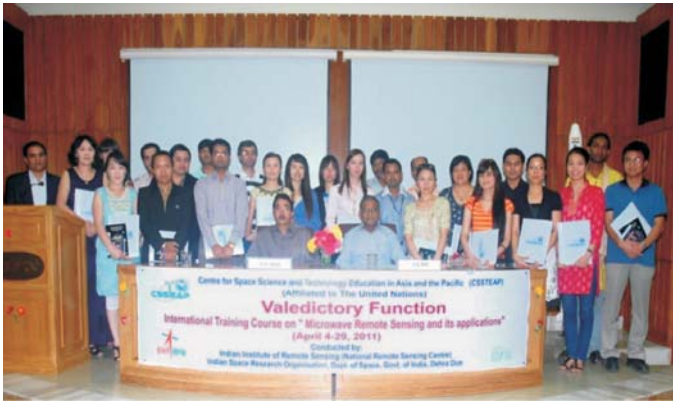
The first two weeks focussed on fundamentals of Microwave Remote Sensing, RADAR Target Interaction, Microwave Sensors, RADAR Image Interpretation, SAR Image processing and analysis, and the second week focussed on

SAR Interferometry, Differential Interferometry, SAR Polarimetry fundamentals and data processing.

In the last two weeks emphasis was on Microwave remote sensing Applications in Agriculture & Soils, Forestry, Urban & Land use mapping, Hydrology & Oceanography, atmosphere and Geology. The participants also carried out a small case study in the area of their interest.

The lectures were delivered by the experienced faculty





drawn from various ISRO centers such as Indian Institute of Remote Sensing (IIRS), Space Application Center (SAC), Ahmedabad, National Remote Sensing Center (NRSC), Hyderabad and Regional Remote Sensing Center

(RRSC), Dehradun and also from National organization such as Indian Institute of Technology –Bombay (IIT-B). At the end of the course one day educational visit to Agra was also organized.

The participants were provided with a DVD consisting of lecture notes, presentation material and open source free software's (NEST, POLSARPRO, ASF Map Ready, SAR Tools etc).

At the end of the course a formal feedback of the course was taken. All the participants expressed overall satisfaction about the course as it provided a comprehensive overview of microwave remote sensing technology and its application. They appreciated the quality of information content, delivery and practical exercises.

**Shefali Agrawal**

## APPLICATION OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM: AN OVERVIEW FOR ISS OFFICERS

Short course on "Application of Remote Sensing and Geographical Information System : An Overview" for Indian Statistical Service (ISS) Officers was organized by IIRS during June 21-24, 2011 sponsored by National Academy of Statistical Administration (NASA), Ministry of Statistics & Programme Implementation, Government of India. The course was attended by 12 officers representing various ministries / departments which include Ministry of Statistics & PI, Ministry of Chemicals & Petro-chemicals, Unique Identification Authority of India, All India Institute of Health & Hygiene, Planning Programme Monitoring & Statistics, Directorate of Economics & Statistics, Ministry of Water Resources, Research and Publication unit, Karnataka Minor Irrigation. The aim of the course was to make course participants familiar with the applications and utility of Remote Sensing and GIS. Lectures and practicals/demonstrations were organized on Remote Sensing, GIS and their applications and were taken by faculty of IIRS. A half-day field work was also organized to Mussoorie and Dehradun to relate image elements with land



use / land cover and GPS / Mobile Mapping demonstration. The officer trainees showed interest in the lectures and practicals / demonstrations and expressed satisfaction on the manner the course was structured and conducted.

**B.S. Sokhi**

## SPECIAL TRAINING PROGRAMME FOR SAARC MEMBER COUNTRIES

Special Training Programme on "Geoinformatics for Disaster Management" was organized jointly by SAARC Disaster Management Centre (SDMC), New Delhi and Indian Institute of Remote Sensing (IIRS), Dehradun, during July 4-17, 2011. It was the third course conducted at IIRS in collaboration with SDMC, but unlike previous two courses the duration of this course was

extended from one week to two weeks based on the feedback of course participants. The course was attended by 21 participants from 5 SAARC Member Countries (Afghanistan-2, Bangladesh-7, India-7, Nepal-3, and Pakistan-2).

The course contents were designed to meet the requirements of multidisciplinary background of the



participants. In the first week, the focus was on concepts and overview of disaster management and geoinformatics with an emphasis on the role of Earth Observation data, GIS and GPS, including mobile-GIS and Web-GIS, in disaster management. In the second week, the focus shifted towards specialized topics related to three major types of hazards, i.e. geological hazards, hydro-meteorological hazards and environmental hazards. Comprehensive lecture and practical/demonstration notes prepared by the course faculty were provided to the participants along with supplementary reading material.

The inaugural function was presided over by Dr. R.S. Tolia, Chief Secretary (Retd.), Govt. of Uttarakhand, while the valedictory function was presided over by Dr. V.B. Mathur, Dean, Faculty of Wildlife Sciences at Wildlife Institute of India, Dehradun. Apart from

IIRS faculty, subject experts from premier institutions like National Remote Sensing Centre (NRSC), National Institute of Hydrology (NIH), Indian National Centre for Ocean Information Services (INCOIS), Indian Institute of Technology (IIT) - Kharagpur and Roorkee, Jawahar Lal Nehru University (JNU), and United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) also shared their knowledge and experience with the participants.

It is hoped that the knowledge gained by the participants in this course will be useful in applying the Geoinformatics technology to address various issues related to natural hazards and disaster management in the SAARC countries.

**S.K. Srivastav**



## P.G DIPLOMA IN NATURAL HAZARDS AND DISASTER RISK MANAGEMENT (NHDRM)

Recent advancements in space technology and allied Geoinformatics Technology (GIT) have provided immense opportunities to disaster managers around the world to use GIT for mitigating the disastrous effect of natural and man-made disasters. Several international initiatives have been taken up to institutionalize the effective use of the GIT mainly Earth Observation data utilization through national and international frame work of disaster management. Towards this, IIRS in collaboration with Faculty of Geo-Information Science and Earth Observation (formerly known as ITC), Twente University (TU), The Netherlands has introduced modular courses (M. Sc and PG Diploma) on Geoinformation Science and Earth Observation with specializations Natural Hazards and Disaster Risk Management (NHDRM). These courses are being successfully organized as Joint Education Programme (JEP) between two institutions since 2001. These courses under JEP have not only provided educational opportunity to participants, but also enhanced the ability to undertake



research on both GIT and its application in disaster management. These courses as dynamic as the technology itself and constantly evolved to meet the ever growing demand of disaster management. In year 2010, ten

participants (including three from Venezuela) had joined for PG Diploma and five for M. Sc (NHDRM). Nine candidates have completed the P.G. Diploma course in July 2011 and were awarded Post Graduate Diploma certificates. The valedictory function was graced by Dr. P. Nag, Director, NATMO, Kolkata as Chief Guest, Dr. D.G. Rossiter from ITC Netherlands as Guest of Honour and Dr. P.S. Roy, Director,

IIRS, faculty members, staff members and course participants of other courses of IIRS. So far 115 participants have attended these courses and after successful completion they have found placement/ higher study opportunities in national and international organizations.

**P.K. Champati Ray**

## SPECIAL TRAINING COURSE FOR GSI PERSONNEL ON APPLICATIONS OF GEOINFORMATICS IN GEOMORPHOLOGY

A four week training programme on "Applications of Geoinformatics in Geomorphology" sponsored by Geological Survey of India (GSI) was conducted at IIRS, Dehradun during 5th to 30th September, 2011. It was attended by twenty (20) participants from various regions of GSI. The group consisted of young geologists and geophysicist involved in the remote sensing application projects of GSI with back ground exposure of Geoinformation technology.

The training programme was aimed at apprising the participants about the advances in geoinformation technology for terrain mapping, use of earth observation (EO) data and creation of database and familiarization with NGLM project schema. The training programme was a combination of lectures, practical demonstrations, exercises, field visits and mini project work encompassing various types of geomorphic landforms that are observed in India and surrounding areas. The unique aspect of the training program was to apprise the field oriented geologists about the latest geoinformation techniques including generation of Digital Elevation Model (DEMs) using Cartosat-1 data sets etc. The training program also included one mini pilot project that consisted of two weeks to expose the participants to carry out individual projects for generation of geomorphology map using NGLM schema. Highly experienced guest faculty were specifically invited in

this programme to share their experience and expertise with the participants. This training programme has strongly brought out the efficacy and effectiveness of Geoinformation science for geomorphological mapping specifically in rugged Himalayan terrain and enlightened the participants about its advantages and limitations. The project work provided ample opportunity to all course participants to carry out a geomorphological mapping project starting from initial data collection, georeferencing of satellite images, interpretation, digital database generation, field verification, to map finalization, visualization, analysis and presentation.

**I.C. Das and P.K. Champati Ray**



## A TRYST WITH POKHRA THROUGH PARTICIPATION OF ISRO IN PROMOTING MULTIDIMENSIONAL DEVELOPMENT IN REMOTE AREAS OF GARHWAL HIMALAYA

**A**midst the picturesque mountainous terrain, Pokhra in Garwal Himalay came in direct contact with scientists of Indian Space Research Organisation (ISRO), Defence Research and Development Organisation (DRDO), Department of Science and Technology (DST) and many organisations during an "Exhibition cum fair on Multidimensional Development & Technology" on 16-18 September 2011. This event was organised by DST

(represented by Dr. S.K. Pandey) with active support and initiative of Shri. Satpal Maharaj, Honourable Member of Parliament (Lok Sabha) and Chairman, Standing Committee on Defence, Member, Public Accounts Committee. Director IIRS nominated Dr. P.K. Champati ray (Head, Geosciences Division) and Dr. Ajanta Goswami (Scientist/ Engineer-SD) to represent ISRO in this event. With coordination and help from Mr. S. Satish, Director,

P&PR and Mr. B. R. Guruprasad, PRO the exhibition materials consisting of models of PSLV, GSLV, GSLV Mk-III, Chandrayaan-1, Cartosat-1, Resourcesat-1 and several high quality posters on achievements and accomplishments of ISRO were put up for demonstration and awareness generation.

Young and old alike were extremely excited to see and touch ISRO models and panels; they themselves put up the stall and offered to extend all possible help. During exhibition students, social activists, govt and private sector workers, villagers (more than 1000 visitors) took keen interest in knowing about ISRO and its mission. Many people became emotional on seeing, touching and feeling the technological achievements of India and feeling being a part of it. It was like a fresh dose of patriotism and enthusiasm injected into their inquisitive mind.

Our aim was to reach to people from remote part of India, make them aware of scientific and technological achievements of ISRO and its use for societal benefits, and encourage young students to learn from space science and contribute to society. This programme provided opportunity to interact with local population and understand their problems. It was heartening to note that local officials, villagers and young students took keen



interest in ISRO initiatives, namely Disaster Management (DM) programme particularly landslide hazard mitigation, Chandrayaan-1, road and infrastructure development using high resolution data, Bhuvan, Village Resource Centre (VRC), telemedicine, tele-education, training and education at IIRS and many more.

It was a memorable tour, we had a narrow escape from a leopard and landslides but in spite of that visited a landslide causing treat to a village at Bhainswara and recommended for further studies by state government and explained basic cause of subsidence and landslides to villagers.

## BRAIN STORMING MEETING ON POLICY INITIATIVES FOR LANDSLIDE HAZARD MITIGATION

National Disaster Management Authority (NDMA), an apex body constituted by the Govt. of India under the Chairmanship of Hon'ble Prime Minister formulates policy and guidelines to mitigate Natural Hazards. NDMA has prepared and released Guidelines on Management of landslides and snow avalanches in June, 2009. It has initiated a proposal to take up a National Landslide Risk Management Project (NLRMP) in the Eleventh Five-Year plan. In a broader sense, it proposed to consider various issues in its National Disaster Management Guidelines. Towards this NDMA has initiated various efforts to consult stake holders, state and central government agencies to evolve policy guide lines that would contribute towards minimizing the effect of landslide hazards. It is envisaged to look at both long term and most importantly short term measures that can be adopted within shortest possible time using existing administrative mechanisms. In this endeavour, a meeting was organized at IIRS, Dehradun on 15 July 2011 to deliberate on the following broad agenda points: 1) Early Detection of Landslides and Response Mechanism; Scientific (actionable) data requirement for landslide hazard assessment (Precipitation, Geological, Socio-economic, Satellite data, etc.) and mechanism/ protocol for data sharing for decision making related to mitigation measures;



Mechanism for initiation of mitigation measures at known vulnerable locations as shown on existing LHZ maps; Landslide hazard assessment in new areas and prioritization; Mechanism for developing guidelines for safe road construction i.e. mainstreaming landslide risk reduction strategy in development planning; Criteria for selection of landslides for mitigation measures; and Awareness generation for minimizing the impact of landslide disasters.



This meeting was chaired by Mr. T. Nanda Kumar, Honourable Member, NDMA, and was attended by Mr. P.K. Tripathi, Joint Secretary (Mitigation), NDMA, Secretary (Disaster Management), Uttarakhand Govt., Director, DMMC, Dr. P. K. Champati ray, Head, Geosciences division and all faculty members of Geosciences Division of IIRS, RRSC-N (NRSC), GSI, representatives of line departments of Uttarakhand, CBRI (CSIR), CSIO (CSIR), G. B. Pant Institute of Himalayan Environment & Development, Almora. Prior to the meeting, the Honourable member along with officials from IIRS, CBRI, DMMC, CSIO, Haridwar district administration, PWD, State Mining and Geology Unit visited the Mansa Devi landslide in Haridwar to

understand the ground conditions of landslide, its immediate threat, vulnerability of population and remedial measures proposed by the state government. The visit to Mansa Devi landslide and meeting provided opportunities to deliberate on many issues starting from early warning to mitigation. The follow up action have been proposed to be taken up by NDMA and state government in consultation with experts from scientific organizations. During the visit of dignitaries to IIRS, Dr. P.S. Roy, Director, IIRS apprised about activities of institute and a presentation was made on training and education efforts under JEP (in collaboration with ITC, the Netherlands) of IIRS in Disaster Management.

**P.K. Champati Ray**

## ENERGY BALANCE APPROACH FOR SNOWMELT RUNOFF ESTIMATION: INITIAL RESULTS

The energy balance or the heat budget of a snow pack derives the production of snow melt water. The important parameters that govern the snowmelt processes are radiation energy, sensible and latent heat, surface temperature, energy transferred through rainfall over snow and heat conduction from ground to the snowpack. Proper budgeting of these energy driven processes is required and is important for efficient management of water resources. In order to study the energy balance approach for snowmelt runoff estimation a part of North-Western Himalayas i.e. Manali sub-watershed is considered which lies in the state of Himachal Pradesh, India, and covers an area of about 350 km<sup>2</sup>. The region experiences snowfall from December to February with January being the coldest month, observing the lowest temperature in the year. Previous studies have been carried out using the Temperature index approach which considers only air temperature, snow cover area and degree day factor

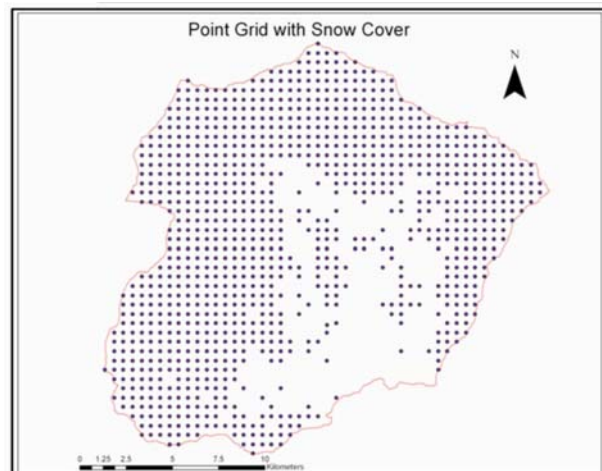
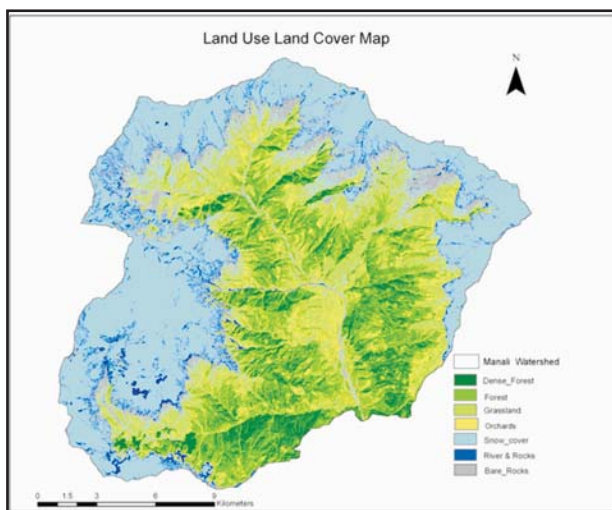
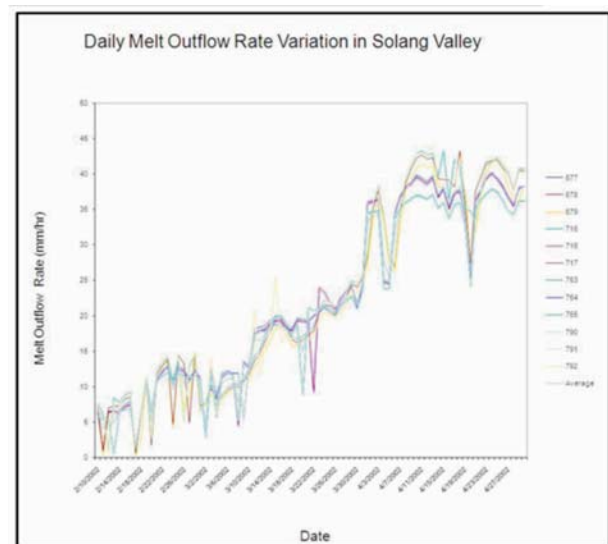


Figure 1: (a) LULC Map of Manali sub-watershed (b) Snow cover point map, (c) Initial results over Solang Valley.

for snow melt generation and not the actual energy exchange taking place. Energy balance approach has been applied in this study over seasonal snow cover at Solang and Dhundi field stations of SASE within the Manali watershed. Meteorological data from 2001 to 2005 over the basin has been used and remote sensed data from Landsat ETM+ and IRS P-6 LISS-III of the same period is used.

A physically based point Utah Energy Balance (UEB) model was used to simulate the energy exchange processes and to estimate the amount of snowmelt generated. The weather file, model parameter file, site variable file and Bristow-Campbell parameter file are derived using remote sensing data and data products, meteorological data and literature. The UEB model runs on diurnal basis only over snow cover area to estimate the runoff generated as a result of this snow melt. The snow cover area was estimated using NDSI with incorporation of NDVI to account for the snow over vegetation. Daily snow cover area maps are obtained by

linearly interpolating the snow cover maps derived from Landsat ETM+ images in ENVI Software (Band Math). ALOS PRISM and IRS P-6 LISS-III images were fused for image enhancement and Land Use Land Cover (LULC) map was obtained from IRS P-6 LISS-III. The model was initialized with values of initial energy content, initial water equivalent and initial snow cover as, 2032.32 kJ/m<sup>2</sup>, 0.706 m and 0.081 respectively. The UEB model's initial results were found good and acceptable for few of the points in Solang valley and Dhundi area for which it was run. Diurnal variation is observed in the melt (afternoon being more than the forenoon value). Extensive coding is being done to run the point model as semi-distributed model with integrated non-snow area runoff and routing model. The model is run from 1 January 2002 to 31 May 2002 and melt outflow rate is obtained.

**Tripti Dimri, Praveen K. Thakur and S.P. Aggarwal**

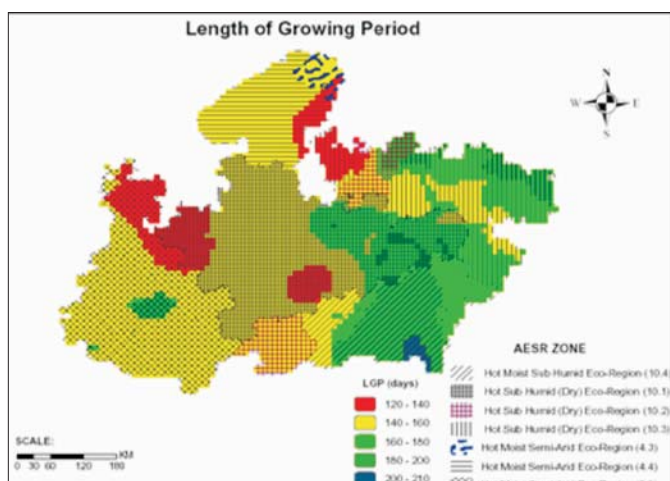
## FAO-AEZ APPROACH IN AGRICULTURAL LAND USE PLANNING IN RAINFED AGRO-ECOSYSTEM

Rainfed agro-ecosystem has a distinct place in the Indian agriculture. Nearly two third of the nation's cropped area is under rainfed agriculture. The potential of rainfed lands for crop production is constrained by biophysical parameters such as length of growing period (LGP), water limited yield potential, soil and land potential controlled by climatic variables, soil types, terrain condition and physiography of the region. Limited attempt has been made in the country so far to prepare agricultural land use plan based on potentiality of land considering crop-specific limitations and potentials of prevailing climate, soil, and terrain resources at regional scale. With an objective of Agro-climatic characterization to assess biophysical limitations and production potential of soils in rainfed region it was decided to create digital database of soils, monthly climate

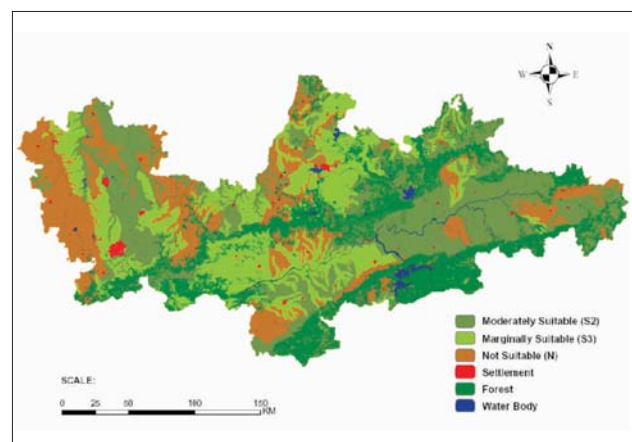
and terrain and other agro-climatic parameters, to assess biophysical production potential of agricultural crops and yield gap analysis and to generate optimal agricultural land use plan using Food and Agriculture Organisation - Agricultural Ecological Zoning (FAO- AEZ) approach.

Three types of methodologies were developed in the project to assess spatial potential suitability of land for crops for agricultural land use planning in rainfed region.

- (i) Geospatial approach in assessing Agro-climatic suitability of crops in rainfed agro-ecosystem for agricultural land use planning in Madhya Pradesh. The crop-specific LGP and water limited yield potential were integrated with FAO based crop-specific soil suitability maps to identify areas with



Spatial distribution of LGP in Madhya Pradesh



Crop-specific (soyabean) suitability map in part of Madhya Pradesh State, India based on FAO-AEZ approach.

highest potential for a specific crop in the region to optimize crop production.

(ii) Derived length of growing season using SPOT- NDVI time series and water satisfaction index (WRSI) for crop monitoring and estimation of water-limited yield for the dominant crops using FAO-Agrometshell for crop planning in Rajasthan. The water-limited yield potential was computed for these crops by relating the WRSI to crop yield estimate using the FAO yield-water use model.

(iii) Land quality index (LQI) based approach in assessing actual potential suitability for rainfed crop by integration of soil quality index (SQI) and climate quality index (CQI) in Gujarat state. Spatial CQI was derived by integration of wetness index (WI) and NDVI to assess actual climatic yield potential.

**Dr. Suresh Kumar, Dr. N.R. Patel and Dr. S.K. Saha**

## CELEBRATION OF NATIONAL REMOTE SENSING DAY AT IIRS

12th August is observed as "National Remote Sensing Day" all around India. In this context, ISRS-DC had celebrated the occasion at Indian Institute of Remote Sensing Dehra Dun with an emphasis to create awareness among the school children. The event was attended by the school children, faculty of IIRS, students, trainees, staff of IIRS, RSSC (N) and CSSTEAP. Dr. S. K. Saha, Chairman, ISRS-DC briefed the gathering about the significance of the occasion. This was followed by the debate competition and quiz competition. The topic of the debate was: "Is Remote Sensing Essential for Sustainable Development?". Dr. G. Philip, Vice-Chairman ISRS DC and Dr. P. K. Champatiray, Head, Geosciences were the judges for debate competition. Prof. B. S. Sokhi, Head HUSAD, conducted the Quiz Program. There was also a poster exhibition displaying remote sensing applications.

A popular lecture was delivered by Sri A. K. Wahal, Director General FSI, Dehradun on the topic of: Geomatics : Awareness and Role in Good Governance".



Sri Wahal has lucidly elaborated the effectiveness and importance of geomatics in the present scenario. He narrated various examples related to map generation and its usefulness for managers in various situations. The event culminated with a formal vote of thanks .

**A.K.Mishra**

## CULTURAL NIGHT: CHHAU DANCE

**R**ecreation Club, IIRS organized a cultural night on the occasion of 15th RS and GIS CSSTE-AP course students passing out on 29th March 2011. In this event, SPIC MACAY's Tarapad Rajak group from Purulia, West Bengal performed Purulia's famous Chhau dance. It is a genre of Indian tribal martial dance whose origin is attributed to Mayurbhanj, an erstwhile princely state of Orissa which is popular in the Indian states of Orissa, Jharkhand and West Bengal. There are three subgenres of the dance, based on its places of origin and development, Seraikella Chhau, Mayurbhanj Chhau and Purulia Chhau. The most prominent difference among the three subgenres is in the use of mask. While, the Seraikela and Purulia subgenres of Chhau use masks, the Mayurbhanj Chhau uses none. More details about Chhau Dance can be found at [http://en.wikipedia.org/wiki/Chhau\\_dance](http://en.wikipedia.org/wiki/Chhau_dance).



This event was solely sponsored by CSSTE-AP, which was very much appreciated by IIRS family.

**Vaibhav Garg**

## CLASSICAL VOCAL CONCERT BY MISHRA BANDHU

On the valedictory of CSSTE-AP short course on "Microwave Remote Sensing and Its Application", Recreation Club (RC), IIRS in association with SPIC MACAY organised Classical Vocal Concert by famous Mishra Bandhu on 28th April 2011. The duo, Ritesh and Rajnish Misra of the Banaras Gharana have performed at various prestigious concerts all over the world. Their work with famous composer Micheal Nyman has been released as an album (SANGAM) selling worldwide. They have sung 3rd track "Mahadeva" in the album called 'Rise', that has been nominated for the prestigious 'Grammy Awards'. They have given background score to the audio book by Penguin & ANB publisher. They are 'A' grade vocalists of All India Radio and Television. They have been awarded the prestigious 'Yuva Ratna Award' for the year 1999. They have also received the prestigious "Bhavishya Jyoti Award" for the year 2007. They have received the prestigious "Sangeet Natak Akademi's Ustad Bismillah Khan Award" for the year 2008. They have recently been conferred with "Sangeet Samridhi Samman". (<http://www.riteshrajnishmishra.com/home.htm>).

In the Mishra Bandhu concert they touched the audience's heart with melodious voice and sensuous application of notes. Skilled with rich knowledge of Indian Ragas the duos render various classical forms. During the interaction with artists; all faculty, staff and students clarified their queries on Indian classical music and instruments.



## BLOOD DONATION CAMP

Recreation Club (RC), IIRS also conducted "Voluntary Blood Donation Camp" in association with IMA Blood Bank of Uttarakhand on 25th May 2011. A huge response was received from IIRS faculty, staff and students for such a noble cause. IMA Blood Bank collected 50 units of blood from IIRS on this occasion. Medical check up of each donor has been carried out by a team of doctors from IMA Blood Bank. Every donor has been automatically covered under a Donor Insurance Policy and provide with Donor Card and a Blood Test Report of Blood Group, Hepatitis B, C, Malaria and Syphilis along with certificate of appreciation. Refreshment has also been provided to each donor by IMA Blood Bank, Uttarakhand.

Through this article, RC, IIRS would like to thank all its members and participants of above event. We expect such a nice response in the events to come from you all.



## स्वतंत्रता दिवस समारोह

15 अगस्त, 2011 को स्वतंत्रता दिवस के अवसर पर कार्यवाहक निदेशक डॉ. एस. के. साहा ने ध्वजारोहण किया। सभा को संबोधित करते हुए उन्होंने सभी को स्वतंत्रता दिवस की बधाईयाँ दी और आई.आई.आर.एस. व इसरो की गतिविधियों से अवगत कराया।

ध्वजारोहण तथा निदेशक महोदय के भाषण के पश्चात् समस्त उपस्थित कर्मचारियों, उनके परिजनों तथा छात्र-छात्राओं को मिष्ठान वितरण किया गया। इस समारोह को आगे बढ़ाते हुए मनोरंजन क्लब द्वारा विभिन्न आयु वर्ग के लोगों के लिए खेल-कूद प्रतियोगिताएं आयोजित की गईं और सभी विजेताओं को कार्यवाहक निदेशक महोदय द्वारा पुरस्कृत किया गया।

वैभव गर्ग



## CAMPUS NEWS : NEW FACULTY

Dr Arijit Roy joined IIRS in April, 2011 as Scientist/Engineer -SE in Forestry and Ecology Division. He is Ph.D. (Ecology) from Faculty of Science and Postdoctoral from Computer Center, Banaras Hindu University, Varanasi. He has been associated with ISRO since March 2004 and prior to joining IIRS, he was Sci/Engr -SE at Forestry and Ecology Division, NRSC, Hyderabad.



Charu Singh joined IIRS in August, 2011 as scientist/Engineer -SC. She is M.Sc. (Physics)

From IIT Roorkee and M.Sc. (Engg.) by research from IISc Bangalore. She has been associated with ISRO since Feb 2008 and prior to joining IIRS, she has worked at SAC Ahmedabad.



### Superannuation's

IIRS family bids adieu to our colleagues who superannuated recently



Sri Ganga Ram  
(Sr. LVD 'A')  
30.06.2011



Sri M.S. Sheena  
(Sr. Draughtsman 'B')  
31.07.2011



Sri A.V. Singh  
(Jr.Engineer)  
31.07.2011

**EDITOR:** Minakshi Kumar

**Members:** Dr. Sadhana Jain, Dr. Arijit Roy, Sr. A.K.Sardar, Dr.Ajanta Goswami, Shri. P.K.Gupta, Dr. Vaibhav Garg, Ms. Mamta Kumari, Ms. Pooja Jindal

## TRAINING CALENDAR 2012

Sl. No	Course Code	Course Name	Entrance Requirements	No. of Seats	Starting Date dd mm yy	Passing Out Date dd mm yy	Course Fee for Individual Candidate			Apply by Date
							Govt. Spons. ₹	Open ₹	Foreign US \$	
<b>POST GRADUATE DIPLOMA COURSES</b>										
1.	D-AS	Agriculture & Soils	M.Sc in Agriculture/B.Sc. Agriculture (4 years)/B.E./ B. TECH in Agriculture Engg./Master in Geograpy/ M.Sc. Environmental Science	6	20.08.2012	15.06.2013	Nil	60,000	6,000	18.05.2012
2.	D-FE	Forestry & Ecology	M.Sc. Forestry/Ecology/Botany/Wildlife Sciences/ Zoology/ Environmental Sciences/ Master in Geography, / B.Sc. Forestry (4 Years) / Forest Officers (B.Sc.+ 2 years experience)	6	20.08.2012	15.06.2013	Nil	60,000	6,000	18.05.2012
3.	D-GG	Geosciences	M.Sc./M.Sc.(Tech.)/M.Tech. in Geology/Applied Geology/ Geophysics/ Earth Sciences/ Geoexploration/ Petroleum Engineering or equivalent / Geoengineering/ Mining Engineering/ Environmental Sciences, Geography Geography (Specialization in Geomorphology) or B.Tech. /B.E. in Civil Engineering, Geosciences, Petroleum Engineering, Mining Engineering, Mineral Processing.	6	20.08.2012	15.06.2013	Nil	60,000	6,000	18.05.2012
4.	D-MS	Marine & Atmospheric Science	M.Sc. in Marine Science/Earth Science / Geography/ Natural Science / Physics/ Atmospheric Science/ Environmental Sciences.	6	20.08.2012	15.06.2013	Nil	60,000	6,000	18.05.2012
5.	D-UR	Human Settlement Analysis	Master in Planning / B.E. (Civil) / B. Architecture / B. Planning / Master in Geography	6	20.08.2012	15.06.2013	Nil	60,000	6,000	18.05.2012
6.	D-WR	Water Resources	B.E. / B.Tech. / M.E. / M.Tech. Civil Engineering / Agricultural Engineering / M.Sc. in Geology / Environmental Sciences	6	20.08.2012	15.06.2013	Nil	60,000	6,000	18.05.2012
7.	D-PR	Photogrammetry and Remote Sensing	BE/B.Tech./M.Sc./M.Tech. Physics, Maths,App. Maths, Statistics, Geophysics,Meteorology, Oceanography, Geology, Physical Science,Earth science, Natural/ Environmental Sc., Geoinformatics/Master in Geography or MCA (with B.Sc. degree). The candidates should have mathematics as one subject upto 10 + 2 level. Govt. employee with Bachelors degree in science and 2 years experience.	6	20.08.2012	15.06.2013	Nil	60,000	6,000	18.05.2012
<b>M.TECH. COURSE</b>										
8.	+M-RG	M.Tech. in RS & GIS	M.Sc. in Natural/ Physical Sciences /Geography/ M.Sc. Geoinformatics/Geomatics/ Earth Sciences/ Geoexploration/ PetroleumEngineering or equivalent / Geoengineering/ Mining Engineering/ Environmental Sciences/ Natural Hazards/ Disaster management B.E. Or B.Tech. (Civil Engg. & Agricultural Engg.) Elec. and Electronics/ Computer Sciences/Computer Engg./ B. Tech. Geoinformatics Engineering, or B.Tech (IT) / B.E. in Geosciences / Geomatics, Petroleum Engineering, Mining Engineering, Mineral Processing / B.Arch./ M.Planning / B.Planning/ / Master in Computer Applications (with B.Sc. degree) / B.Sc. (Forestry / Agriculture, both with 4 years duration course).	20	20.08.2012	14.08.2014	Nil	1,44, 000 + 20,000 (Andhra. Fee) Univ. Regn	14,400 + 250 (Andhra Univ. Regn. Fee)	11.05.2012
<b>GEOINFORMATICS : TECHNOLOGY AND APPLICATION</b>										
9.	D-GI IIRS-ITC Joint Education Program	Post Graduate Diploma in Geoinformation Science & Earth Observation with specialisation in	M.Sc. / M.Tech. Degree in Physics, Mathematics, Applied Mathematics, Statistics, Geophysics, Meteorology, Oceanography, Geology, Agriculture, Urban and Regional Planning, Remote Sensing OR any Natural/Environmental Sciences, Master in Geography / B.E. / B. Tech. (Civil Engineering / Electronics and Communication, Computer Science/ Computer Engineering / IT/Agricultural Engineering /MCA (with B.Sc. degree).	10	24.09.2012	19.07.2013	Nil	65,000	Euro 3000	22.06.2012
10.	M-GI IIRS-ITC Joint Education Program	M. Sc. in Geoinformation Science & Earth Observation with specialisation in Geoinformatics	M.Sc. / M.Tech. Degree in Physics,Mathematics, Applied Mathematics, Statistics, Geophysics, Meteorology, Oceanography, Geology, Agriculture, Geography, Urban and Regional Planning/Remote Sensing OR any Natural/Environmental Sciences OR BE/B. Tech. (Civil Engineering / Electronics and Communication / Computer Science / Computer Engineering / IT/Agricultural Engineering / B. Tech. In Geoinformatics / B.Sc. (4 years) Agriculture / Forestry or equivalent OR MCA with Science Graduation or M.Sc. in IT.	10	24.09.2012	21.03.2014	Euro 2000 payable to ITC + ₹ 2,00,000 Approx. own expenditure for visit to ITC)	1,20,000 payable to IIRS + Euro 2000 payable to ITC + ₹ 2,00,000 Approx. own expenditure for visit to ITC)	Euro 6250	25.05.2012
11.	D-NHDRM IIRS-ITC Joint Education Program	PG Diploma in Geoinformation Science & Earth Observation with specialisation in Natural Hazards & Disaster Risk Management	M.Sc. in Natural Sciences / Earth Sciences / Physical Sciences or B.Arch/ B.Planning / M. Planning or B.E. / B.Tech. in Civil Engineering/ Agricultural Eng./ Environmental Eng/ Geosciences/ Geoexploration/ Earthquake Engineering or B.Sc. (Forestry / Agriculture, both with 4 years duration course) or Master in Geography or Forest Officers (Graduates in Science with 2 years experience).	10	24.09.2012	19.07.2013	Nil	65,000	Euro 3000	22.06.2012

- Note :
- Master degree should be with Bachelor in Sciences.
  - Preference will be given to Mathematics in 10+ 2 standard.
  - Candidates should have secured a minimum of 55% marks in the qualifying examination.
  - M.Tech. is accredited by Andhra University, Visakhapatnam and from 2nd module onwards the students admitted to this course will have to select one of the following disciplines:
  - Agriculture and Soils, (ii) Forestry and Ecology, (iii) Geosciences, (iv) Marine and Atmospheric Sciences,(v) Human Settlement Analysis and (vi) Water Resources (vii) Satellite image processing & photogrammetry (viii) Geoinformatics
  - The admission for M.Tech. course is based on entrance test and interview. The candidates with valid GATE certificate having higher percentile will not be required to appear in the entrance test. However they will also be required to appear in the interview along with other candidates. IIRS does not provide any fellowship/ financial assistance to any of its students.

Sl. No	Course Code	Course Name	Entrance Requirements	No. of Seats	Starting Date	Passing Out Date	Course Fee for Individual Candidate			Apply by Date
							Govt. Spons. ₹	Open ₹	Foreign US \$	
12.	M-NHDM IIRS-ITC Joint Education Program	M. Sc. in Geoinformation Science & Earth Observation with specialisation in Natural Hazards & Disaster Risk Management	M.Sc. in Natural Sciences / Earth Sciences /Physical Sciences / Agriculture or M.Sc. In Geography /P.G.in Urban and Regional Planning/ B.Arch/ B.Planning/M. Planning or B.E./B.Tech./ M.E. / M.Tech. in Civil Engineering / Agricultural Engineering /Environmental Eng/ Geosciences/ Geoexploration/Earthquake Engg / or B.Sc. (Forestry / Agriculture, both with 4 years duration course) or M.Sc. Geography.	10	24.09.2012	21.03.2014	Euro 2000 payable to ITC + ₹ 2,00,000 Approx. own expenditure for visit to ITC)	1,20,000 payable to IIRS + Euro 2000 payable to ITC + ₹ 2,00,000 Approx. own expenditure for visit to ITC)	Euro 6250	25.05.2012
<b>REMOTE SENSING APPLICATIONS : THEME SPECIFIC ORIENTATION COURSE</b>										
13.	O-DM	Remote Sensing -An Overview for Decision Makers	Decision makers in organizations (with 10 years experience in service).	10	19.06.2012	22.06.2012	7,000 @	7,000 @	700 @	18.05.2012
<b>INTERNATIONAL PROGRAMMES</b>										
14.	S-RS	Short Course on Remote Sensing with special emphasis on Digital Image Processing (ITEC Sponsored)	Post Graduate degree in natural sciences, graduate in any engineering discipline, or graduate in natural sciences with sufficient knowledge of mathematics/statistics at high school level. Middle level resources managers and professionals from Govt., NGOs, Universities with 2 years work experience relevant to natural science/management/ data-map handling. Age: Upto 45 Years or so.	20	02.01.2012	24.02.2012	20,000	20,000	\$ 2000	25.11.2011
15.	S-GI	Short Course on Geoinformatics (ITEC Sponsored)	Post Graduate degree in natural sciences, graduate in any engineering discipline, or graduate in natural sciences with sufficient knowledge of mathematics/statistics at high school level. Middle level resources managers and professionals from Govt., NGOs, Universities with 2 years work experience relevant to natural science/management/ data-map handling. Age : Up to 45 years.	20	24.09.2012	16.11.2012	20,000	20,000	\$ 2000	26.08.2012
<b>Dates of course at Sl. No. 15 are subject to change</b>										
<b>CERTIFICATE COURSE</b>										
16	C-RS	Short Course on Remote Sensing and Image Interpretation	Engineering Graduate / Post Graduates in Science and Geography.	5	02.01.2012	24.02.2012	Nil	12,000	1200	25.11.2011
<b>NNRMS - ISRO SPONSORED CERTIFICATE COURSES : FOR UNIVERSITY FACULTY ONLY</b>										
17.	N-GI	GIS Technology and Advances	Post Graduate Degree in Science/Engineering Graduate. The candidates should have 2 yrs. teaching experience at PG level.	8	07.05.2012	29.06.2012	Nil	12000	1200	17.02.2012
18	N-WR	RS & GIS Applications to Water Resources	B.E. / B. Tech., M.E./M. Tech.(Civil & Agricultural Engineering) with 2 years teaching / research experience.	8	07.05.2012	29.06.2012	Nil	12000	1200	17.02.2012
19	N-FE	RS & GIS applications to Forestry/ Botany / Ecology / Wildlife / Environmental Sciences	Post Graduate Degree Botany/Ecology/ Forestry/ Environment/ Zoology / Wildlife Science/ Life Science. The candidates should have 2 yrs. teaching experience at PG level.	8	07.05.2012	29.06.2012	Nil	12000	1200	17.02.2012
20	N-UR	RS & GIS Applications to Urban & Regional Planning	M. Planning/ B.E.(Civil)/B. Arch. / B Planning / Master in Geography. The candidates should have 2 yrs. teaching experience at PG level.	8	07.05.2012	29.06.2012	Nil	12000	1200	17.02.2012
21	N-CM	Cartography and Mapping	Post Graduate Degree in Science/Geography. The candidates should have 2 yrs. teaching experience at PG level	8	07.05.2012	29.06.2012	Nil	12000	1200	17.02.2012
22	N-GG	RS & GIS Applications to Geosciences	Post Graduate Degree in Geology/ Applied Geology/ Geophysics/ Geography. The candidates should have 2 yrs. teaching experience at PG level.	8	07.05.2012	29.06.2012	Nil	12000	1200	17.02.2012
23	N-GA	RS & GIS Applications to Agriculture and Soils	Post Graduate Degree in Science/ Agriculture / Geography / Environmental Sciences. The candidates should have 2 yrs. teaching experience at PG level.	8	07.05.2012	29.06.2012	Nil	12000	1200	17.02.2012
24.	N-MA	RS & GIS Applications to Meteorology & Atmospheric Sciences	Post Graduate Degree in Science/ Marine Sciences / Meteorology / Atmospheric / Environmental Sciences. The candidates should have 2 yrs. teaching experience at PG level.	8	07.05.2012	29.06.2012	Nil	12000	1200	17.02.2012

**Note : Please note the following important information:**

- If the date of commencement falls on holiday, course will start from next working day.
- Sponsoring organizations are required to meet all expenses viz., traveling allowance, daily allowance, contingent expenses, medical expenses etc., for their candidates EXCEPT course fee. **However Courses at Sl. Nos. 13, 14 & 15 are paid courses for all including** Govt. organizations also. In case of NNRM sponsored course, the candidates admitted are paid TA/DA by IIRS as per DOS rules applicable for this course.
- The Govt. Organizations (Central / State Government bodies / Autonomous Institutions and State and Central Govt. funded Universities) can sponsor only permanent staff. Private Universities & self sponsored candidates have to pay **full course fee** prior to joining the course.
- Security deposit : Self Financed candidates, have to deposit/ remit security deposit one month prior to the commencement of the course, failing which seats would be offered to the waitlisted candidates, as mentioned further: (i) @ ₹ 4000/- in respect of Certificate Courses (ii) @ ₹ 6000/- in respect of PG Diploma Courses and (iii) @ ₹ 10000/- in respect of M.Sc./ M.Tech. courses.
- Boarding and lodging charges at IIRS Hostel comes to 2500 p.m. (approx.). **Local candidates will be considered for hostel accommodation, only if available.**  
@ Includes boarding and lodging charges for the course mentioned at S.No.13.

For further details, contact: Director / Programme Coordinator (Academic) / Indian Institute of Remote Sensing, ISRO, Dept. of Space, Govt. of India, 4, Kalidas Road, Dehra Dun Pin- 248 001, UTTARAKHAND (INDIA). FAX: 91-135- 2741987; 2748041.PHONE: 91 -0135-2744583, 2746798, 2524105, 2524106, 2524107.  
E-mail: director@iirs.gov.in & pca@iirs.gov.in; also, please log in : www.iirs.gov.in for details and application form.