CENTRE FOR SPACE SCIENCE & TECHNOLOGY EDUCATION IN ASIA AND THE PACIFIC

Announces

20th Post Graduate Course in Remote Sensing & Geographic Information System

conducted at

Indian Institute of Remote Sensing

Indian Space Research Organisation
Department of Space, Government of India, Dehradun, India
URL: www.iirs.gov.in

Academic Year
2015 - 2016

Centre for Space Science and Technology Education in Asia and the Pacific
(Affiliated to the United Nations)
IIRS Campus, 4 Kalidas Road, Dehradun, India - 248 001
URL: www.cssteap.org

CSSTEAP

Governing Board Members and Special Invitee during 19th Meeting at ISRO, Bengaluru on October 31, 2014

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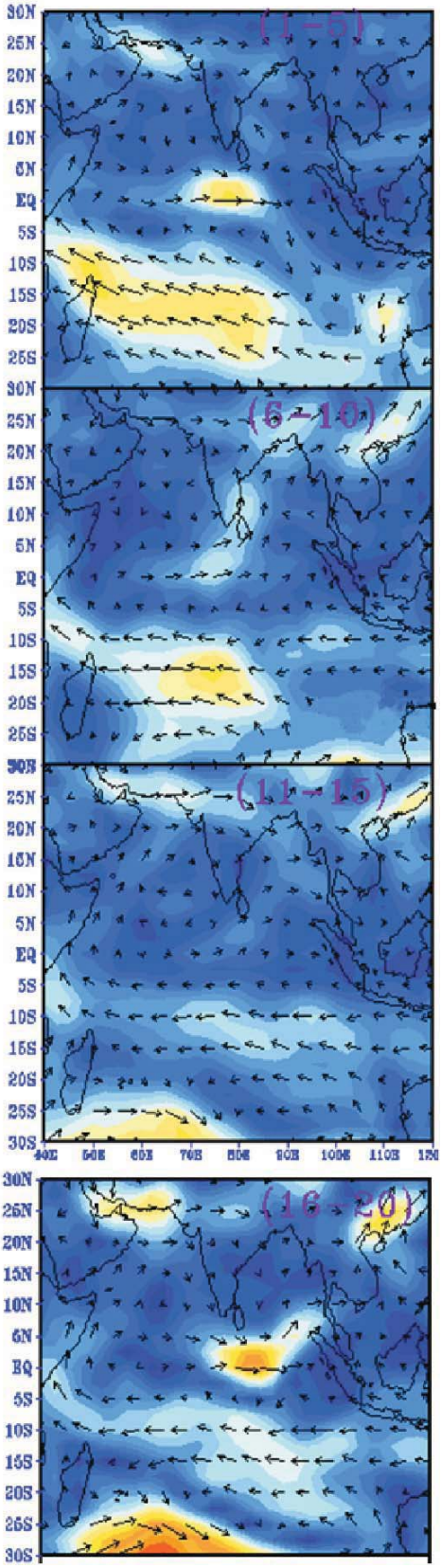
For further detail kindly see our website (www.cssteap.org)

CSSTEAP

CONTENT



NCEP Wind at 850 hpa May 2014

Dr. K. Radhakrishnan, Chairman CSSTEAP GB alongwith GB members during 19th GB meeting

CSSTEAP Headquarters at Dehradun

INTRODUCTION

Space science and technology plays a very important role in improving the quality of life of today's human society for information and decision making. Most noticeable among there are communication, television, telemedicine, satellite navigation, remote sensing data, weather forecasting, disaster mitigation through emergency mapping, etc. All countries, irrespective of rich or poor, have realised the importance of space technology for improving the living conditions of their citizens. Therefore, all countries should have access to space technology and must share the equitable benefits. The global satellite data availability has made it possible for all countries to get benefits. However, a major precondition to successful space technology applications is the development of essential indigenous capabilities, particularly human resources. A consensus emerged within the international community that if effective assimilation and appropriate application of space technology are to succeed in the developing countries, efforts must be made at different levels for capacity building in space technology. Towards this, the United Nations General Assembly called for the establishment of Regional Centres for Space Science and Technology Education at the regional level in the developing countries. Under the auspices of the United Nations, through its Office for Outer Space Affairs (UN-OOSA), the five regional Centres established are: Asia and the Pacific (India), Latin America and the Caribbean (Brazil and Mexico) Africa (Morocco and Nigeria) and West Asia (Jordan). All the Centres are affiliated to the United Nations through UN-OOSA.

ABOUT REGIONAL CENTRE FOR ASIA AND THE PACIFIC IN INDIA

The Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) was established in India in November 1995 with its headquarters in Dehradun and is considered as the Centre of Excellence by UN-OOSA. The 1st campus of the centre was established in Dehradun, India at Indian Institute of Remote Sensing (IIRS) which is a unit of Indian Space Research Organization (ISRO), Government of India. For conducting its Remote Sensing & GIS programmes the Centre has arrangements with IIRS as a host institution. The Centre has also arrangements with Space Applications Centre (SAC) Ahmedabad, playing as host-institution for programmes related to Satellite Communications, Satellite Meteorology and Global Climate, Global Navigation Satellite Systems and Physical Research Laboratory (PRL) Ahmedabad for Space and Atmospheric Sciences.

The Centre has been imparting training and education, helping participants in developing research skills through its Master Degree, Post Graduate and Certificate programmes. This is achieved through rigorous class-room (theory and hands on exercises), group discussions, field campaigns and pilot projects in the field of space science and technology. These programmes aim at capacity building for participating countries, in designing and implementing space-based research information and application programmes. The Centre also fosters continuing education to its alumni.

"It should be emphasized that the overall mission of the centres is to assist participating countries in developing and enhancing the knowledge and skills of their citizens in relevant aspects of space science and technology in order that such individuals can effectively contribute to national development programmes."

AFFILIATION TO THE UNITED NATIONS

The Centre has entered into a cooperative agreement with the United Nations which states that the United Nations will cooperate with the Centre by providing expert advice, educational curricula, technical support, necessary documentation and other appropriate support.

EDUCATIONAL PROGRAMME AND COURSES

The educational programme of the Centre is oriented towards the dissemination of knowledge in relevant aspects of space science and technology. The emphasis of the Centre is to deliberate on education and research for natural resource management along with linkages to the global programmes/databases, pilot studies, continuing education & awareness and appraisal programmes. The curriculum has been developed under the auspices of the UN Office for Outer Space Affairs (UN-OOSA) and the guidelines emerged from the meetings held for Education Curriculum Development for the Centre at Granada, Spain in February/March 1995. These curricula are reviewed periodically by an International Advisory Committee. The activities of the Centre are guided by a Governing Board, Academic Advisory Committee and respective Board of Studies.

ACADEMIC ACTIVITIES

The academic activity is divided into two phases. Phase-I is of 9 months duration and executed at the Centre in India. After successful completion of the Phase-I, the participants are encouraged to take up Phase-II research project of one year duration in their home country. Phase-II allows participants to take up research project relevant to their home country or organization and apply the technologies.

If desired by the candidate the candidate can submit one year research project to Andhra University, Visakhapatnam, India for Master of Technology Degree (M. Tech. Degree). The eligibility criteria of the university will apply.

(i) **Post Graduate programme:** P.G. Diploma Courses of nine months duration are organised in the following disciplines:

- Remote Sensing and Geographic Information System (RS and GIS) (at IIRS, Dehradun)
- Satellite Communications (SATCOM) (at SAC, Ahmedabad)
- Satellite Meteorology and Global Climate (SATMET) (at SAC, Ahmedabad)
- Space and Atmospheric Sciences (SAS) (at PRL, Ahmedabad)
- Global Navigation Satellite Systems (GNSS) (at SAC Ahmedabad from August 2015

Core Modules (Semester I and II) emphasize on the development and enrichment of the basic knowledge and skills of the participants in the technology. This is followed by pilot study, which provides an opportunity to fine-tune the skills for executing theme-based study.

(ii) **Master programme:** This programme gives an opportunity and continuity in developing higher research skills for those who have completed successfully the nine months P.G. Course. This is subject to qualifying for admission requirements of Andhra University, India. A research project by the scholars is conducted and executed in their

Students of 19th RS&GIS course during practical exercise

Participants with faculty at Andhra University, Visakhapatnam

RECOGNITION OF MASTER PROGRAMME

The Centre is in agreement with Andhra University (est. 1926) Vishakhapatnam, India for award of M. Tech. Degree. The terms and conditions of this agreement are reviewed from time to time.

respective countries with a view to transfer the technology in his/her organization. It will also be a test of the methodology and knowledge assimilated during phase-I at the centre.

A few meritorious students after successful completion of P.G. Course are considered for award of additional fellowship of five months to one year to complete part of their research work at Centre's host institutions in India which may lead to a M. Tech. Degree of Andhra University. Research project work needs to be submitted to the Andhra University within four years from the date of registration at the Centre for award of M.Tech. degree.

(iii) **Short Courses:** Besides P.G. level courses, the centre also conducts short term courses of two to four weeks duration in specific themes of above subjects regularly.

PROGRAMMES CONDUCTED

The Centre has so far conducted 43 post graduate courses, 18 on RS&GIS, 9 in SATCOM, 8 each in SATMET and SAS. The centre also conducted 35 short Courses/ Workshops in the last 18 years. These educational programmes have benefited more than 1400 participants from 34 countries in the region and 29 participants from 18 countries outside Asia Pacific region. Nineteenth RS & GIS course at IIRS Dehradun, 9th Satellite Meteorology & Global Climate course at SAC Ahmedabad and 9th Space Atmospheric Sciences course at PRL Ahmedabad are in progress.

Course participants of Microwave RS (SAR) and its Applications at IIRS, Dehradun

SAARC regional training course in Disaster Risk & Emergency Response

NEXT COURSE: 20th P. G. COURSE IN RS & GIS

Duration	:	July 1, 2015 to March 31, 2016
Venue	:	Indian Institute of Remote Sensing Indian Space Research Organization Department of Space, Govt. of India Dehradun - 248 001. Uttarakhand, INDIA
Number of seats	:	20
Last date of receipt	:	February 28, 2015

IMPORTANT DATES

Last date for receipt of applications	:	February 28, 2015
Information of selection	:	April 20, 2015
Commencement of course	:	July 1, 2015
Completion of PG diploma (Phase-I)	:	March 31, 2016

WHO CAN APPLY ?

The course is designed towards the professionals and specialists working in the university system, educational institutes, and involved in active research in Natural Resources (biological and physical) and Environmental management. It is strongly expected that the participating scholars will be able to:

- Serve as catalysts for furthering the skills and knowledge of other professionals in their countries.
- Contribute to policy making, planning, development and management of Remote Sensing & GIS and its applications in their countries.

- Enhance the self reliance of their countries so as to lessen dependence on external experts.

HOW TO APPLY ?

Applications are invited from candidates in countries of Asia and the Pacific Region for the 20th P.G. Course in RS and GIS (www.cssteap.org). All the candidates need to be either nominated or sponsored (i.e. endorsed) by recognized institutions (e.g. departments, ministries or universities in their respective countries). Nominating or Sponsoring institutions/ authority should ensure that on return, the scholar will be given an opportunity to work in a development oriented activity in the area of newly acquired knowledge and skills. The execution of a one year project work in their respective countries is the beginning of this process and it is assumed that sponsoring authority will facilitate one year research project in the home country. However, the Centre will provide long distance technical guidance. A limited number of short (4-6 months) and one year duration fellowships may be made available to meritorious participants to complete Phase-II Research Project work in India.

Please submit this duly filled application form (attached with this anouncement or download from website) to the Centre through/endorsed/nominated by:

a. Governing Board member of CSSTEAP in your country (for details please see website)
b. After nomination/sponsorship through
   - Indian Embassy/High Commission in your country or
   - Your Embassy/High Commission in India

The application should be completed in all respects and accompanied by attested and/or certified copies of all the certificates (School, Bachelor and Master, TOEFL, English Proficiency, etc.). Wherever, if these certificates are issued in a language other than English, then the same must be translated in English and certified by the Head of the organization Department or provide English transcription of all such documents. However, an advance copy may be forwarded at the following address for advance action and follow-up at this end:

Course Director
CSSTEAP-RSGIS-20
Indian Institute of Remote Sensing, ISRO
Department of Space, Govt. of India
4, Kalidas Road, Dehradun - 248 001
Uttarakhand, India
Phone : +91 135 2524226
Fax : +91 135 2740785
Email : cssteap@iirs.gov.in
Website : www.cssteap.org

Since the medium of instruction is in English, therefore, the writing/ reading/speaking knowledge of English in must. **Nominating/ sponsoring agency may kindly note and ensure above condition before forwarding the application.** On arrival in India if the candidate in unable to communicate in English, the candidate will be sent back to his/her country either at the cost of nominating agency or the candidate himself/ herself.

To download application form or to know more about CSSTEAP, its past and future programmes, list of participants and countries who have benefitted from these and the Pilot Projects carried out through these programmes, please visit us at **www.cssteap.org**

Students during their Laboratry exercises

International hostel for course participants at IIRS Dehradun

Indian Institute of Remote Sensing (IIRS) Campus, Dehradun

Participants during Field work

ELIGIBILITY FOR ADMISSION

Master's degree in science or Bachelor's degree in engineering or equivalent qualification relevant in the field of study with at least 5 years of experience in teaching/research or professional experience in the field of natural resources or environment, e.g. agriculture, soils, forestry, ecology, geosciences, water resources, human settlement, land use planning, oceanography, environmental analysis, etc. (For candidates with higher qualifications, the minimum experience may be relaxed). High School-level knowledge in mathematics and/or statistics is essential besides the Master degree as base qualification.

Important
The applicants are advised to bring original documents including academic testimonials for verification at the time of reporting in India.

SELECTION PROCEDURE

The Centre will select the candidates through a well laid procedure, which includes satisfying academic eligibility, proficiency in English language, funding/forwarding by sponsoring authority/organization, country representation, etc. Only selected candidates will be intimated by 31st March 2015 and list of selected candidates will also appear at Centre's web-site (www.cssteap.org). Preference in selection will be given to those candidates whose expenses are borne by the candidate/sponsoring agency. Once a candidate has been sponsored and admitted, the sponsoring authority/organization or candidate need to inform at least 15 days in advance for withdrawal or cancellation of the candidature. If the sponsoring authority wishes to call back its candidate for any unknown reasons after joining the Centre or in the middle of the course, the to and fro travel cost need to borne by either sponsoring authority or by the candidate itself.

ABOUT HOST INSTITUTE

ISRO is a premier government organisation in India for space science and technology missions and developments. ISRO is premier agency for the development Earth Observation and Communication satellites, launch vehicles, etc. Moon and Mars mission are noteworthy amongst several achivements. IIRS (est. 1966) is an unit of Indian Space Research Organization, Department of Space, Government of India and is mandated for education/training in Remote Sensing, Geoinformation Science and GPS technologies. It is a premier institution in imparting training and education in basic technologies and their applications for natural resource management. The institute has very strong R&D programme. The endeavour of the institute has been to bring young, middle as well as senior thematic experts from user communities to educate/apprise about technology/ applications at Post Graduate level with the overall goal of 'technology transfer' and user awareness. The institute has evolved many programmes tuned to the different needs of various target groups. IIRS addresses the cause, awareness and research needs at different levels of management, and therefore, conducts a variety of courses for the different categories of users and fresh students viz., M. Tech., M.Sc., PG Diploma, 4 months Certificate Courses, 2 months National Natural Resource Management System (NNRMS)

sponsored courses for University faculty, 2 weeks on demand Special Courses, 1 week duration Overview Course for Decision Makers and tailor-made courses for users departments from India and abroad. IIRS has so far trained more than 9500 scientists/ engineers. About 925 foreign students from various countries of Asia, Africa and Latin America have also benefitted under SHARES Fellowship programme of the Department of Space, ITEC / SCAAP fellowship scheme of the Ministry of External Affairs, Government of India, other fellowship schemes, etc. For further details visit **http://www.iirs.gov.in**

FACULTY

Centre's core faculty is drawn from IIRS and also from other centres of ISRO/DOS, universities and premier agencies from India and abroad. They have long and varied experience in the field of RS & GIS technology and its applications. The faculty has a strong scientific background with a number of research publications, experience of participating in international scientific programmes, organizing a number of courses, etc. to their credit. A few visiting international experts are also invited to deliver lectures on advance and specialised topics. Experts from USA, UK, The Netherlands, Germany, Thailand, Australia, Japan, UN-OOSA, UN-ESCAP, UN-SPIDER etc. have delivered lectures.

MEDIUM OF INSTRUCTIONS

The medium of the instructions/teaching is English. Proficiency in written and spoken English is most essential. **The candidates who are not proficient in English are advised not to apply.** Applicants, who have done their higher studies in a medium (language) other than English, are required to submit TOEFL score or a diploma/certificate of English language issued by an accredited language institution or by the local UNDP for satisfactory establishment of the applicant's competence in spoken and written English language. Preference will be given to those who secure high score in TOEFL examination. **Nominating agencies are requested to ensure this.**

TEACHING METHODS AND FACILITIES

Modern facilities exist at the Centre for class-room teaching and practical instructions/demonstrations. Printed as well as digital course material of the lectures is supplied. The teaching methods include class room lectures, video lectures, computer based training packages, laboratory experiments, group discussions, demonstrations, seminar presentations and field work/case studies (as applicable). Computer-based interactive multimedia packages are also available for self learning/ revision. The laboratories are equipped with latest Image processing and GIS software. Each participant is given individual computer system. One of the majors strengths of the institute is its library with latest subject literature, text books, e-books, online-journals, etc.

TECHNICAL & EDUCATIONAL VISITS

As a part of the course curriculum, the participants will have the opportunity to visit different centres of ISRO / Dept. of

Students collecting ground truth using spectroradiometer during field work

Participants of SAARC course on Disaster Risk and Emergency Management with Director CSSTEAP and dignitaries

Dr. V Jayaraman Distinguish Professor ISRO distributing Diploma certificates to the participants

Course participants with dignitaries during the valedictory function conducted at IIRS, Dehradun

Space, Govt. of India and other organizations concerned with Remote Sensing and GIS related research.

PEFORMANCE EVALUATION

The performance of the participants is assessed through written, interactive-sessions and/or computer-assisted practical exercises. Independent assessments of theory and practical exams are conducted by external and internal faculty. The participants need to pass each examination paper. Participants, who fail to qualify in the examinations in the nine months course, may be considered for award of only a **"Certificate of Attendance"** by the Centre.

AWARD OF DIPLOMA/DEGREE

On successful completion of the Phase-I study, i.e. nine-months course, the participants will be awarded Post Graduate Diploma. Certificate of Attendance will be given to the candidates who fail to clear the examination. If the participant is able to complete Phase-II project work, i.e. research project in home country satisfactorily within four years of joining the PG course, the candidate can avail the opportunity to submit the work to the Andhra University (India) for award of M. Tech. Degree.

COURSE EXPENSES

The overall expenses of the course is given below, this is besides the international travel (to and from city of the course participant to course venue):

- Course Fee : US $ 6000 per participant
- Local tours : US $ 1200 per participant
- Living expenses : US $ 1100 per participant

The participants are expected to find suitable sponsorships or funding for meeting the expenses while attending the course in India. Preference will be given to such candidates.

FINANCIAL ASSISTANCE TO PARTICIPANTS FROM GOVERNMENT OF INDIA

For this course, Government of India (GOI) has offered to waive off the course fee of US $ 6000 per participant selected by the Centre from the Asia-Pacific region. Thus no course fee is payable by the selected participants from the Asia-Pacific region. GOI will provide financial assistance to few of the selected candidates as mentioned below:

Living expenses in India	:	INR 16,000 per month for the duration of 9 months.
Book allowance	:	INR 2,000 per (one time)
Project allowance	:	INR 1,500 (one time)
Local tour expenses	:	Up to INR 50,000

SUPPORT FROM UN Agencies

UNOOSA, Vienna, UNSPIDER, Beijing and UN-ESCAP, Bangkok have been providing financial assistance to CSSTEAP educational programmes and have extended travel grants to a good number of course participants since its inception. This contribution by UN Agencies is highly supportive to the overall activities of the Centre.

The Centre may offer help to obtain financial assistance for international travel for a limited number of participants of the Asia-Pacific region through agencies like UN Office for Outer Space Affairs (UN-OOSA), UN Economic and Social Commission for Asia and the Pacific (UN-ESCAP).

INSURANCE

Medical, life and disability insurance should be undertaken before leaving their country for India by the participants themselves or on their behalf by their sponsoring institute/organization for covering entire health and disability risks. No medical expenses will be borne by the Centre. However, participants who receive the Fellowship of the GOI will be paid medical expenses for minor ailments on actual basis (as an out patients only) as and when such expenses are incurred. The Centre will have limited liabilities as far as medical expenses are concerned in such cases. Candidates in sound physical and mental health only need to apply.

Medical fitness certificate from Authorized Goverment medical officer covering status of Eye, Chest (Tuberculosis), Vaccinations, heart, lungs, liver, spleen, Hydrocele, skin & V.D., Hepatitis, HIV, Yellowfever and other contagious diseases be enclosed with the application form. In case if any information requiring medical attention is hidden and if found during the course, the centre will be oblized to send the candidate back home any time. The travel cost will be borne either the nominating/sponsoring authority or by the candidate itself.

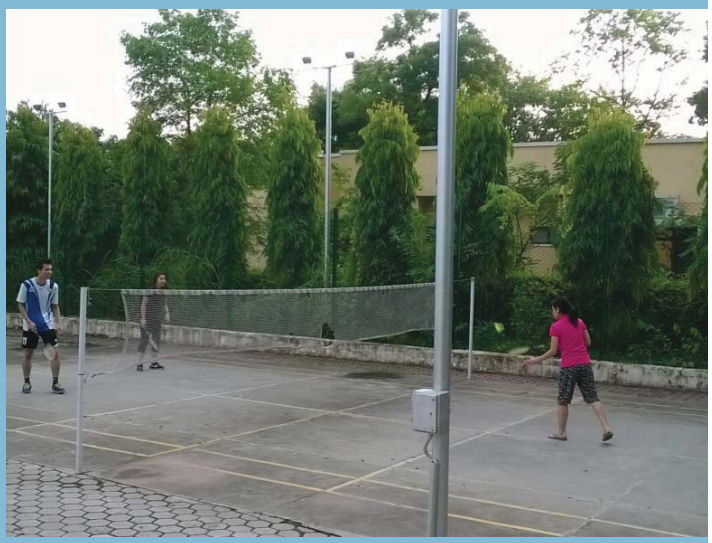
LIFE AT CENTRE

It is mandatory for all the course participants to stay in the Centre's hostel situated in the IIRS Campus. This gives an opportunity for participants to interact and share their knowledge and cultural values. Accommodation on single occupancy basis is provided to all the selected participants. The campus is equipped with good living facilities, like independent kitchenette, gymnasium, tennis court, etc. A sum of INR 1500/-per month is to be paid by the participant towards the accommodation. Boarding and other expenses towards consumables are to be borne by the participants themselves. Since India is country of festivals, unique socio-cultural values, religions, languages, etc. the participants would get to know about different colourful festivals throughout the year.

RS&GIS COURSE AT A GLANCE

Phase-I of RS and GIS Course is divided into two Semesters. Semester-I is of 4 months duration and consists of module-I covering RS, image interpretations and analysis, Photogrammetry, GPS, GIS, advance DIP, RS & GIS and environmental assessment & monitoring. Semester-II is of 5 months duration and consists of two modules, module-II of 2 months focuses on application of RS and GIS in thematic disciplines namely, Agriculture and Soil; Forest Ecosystem Assessment & Management; Geosciences & Geohazards; Marine & Atmospheric Science; Water Resources; Urban & Regional Studies; Satellite Image Analysis & Photogrammetry and Geoinformatics. In module-III of 3 months duration each scholar has to formulate and execute a Pilot Project under the guidance of the faculty. These three modules are described briefly ahead.

Students displaying colourful Rangoli



Sports facility at IIRS Dehradun

Participants of short course on Microwave Remote Sensing

Students spending time in library

SEMESTER-I

First Module (Common) *

- Fundamentals of Remote Sensing.
- Remote Sensing Platforms & Sensors
- Mathematical concepts applicable in Digital Image processing & GIS
- Principles of analysis of Remote sensing data (Visual and digital)
- Photogrammetry
- Overview of Geoinformatics
- Global Positioning System Technology and applications
- Advanced concepts in Remote Sensing and GIS
- Satellite Meteorology
- Natural Disaster Management
- Sustainable Development
- Environmental Analysis, Monitoring & Management
- Seminar presentation

SEMESTER - II

Second Module (Elective) *

Remote Sensing & GIS technology and application in thematic areas (elective) viz.

- Agriculture and Soils,
- Forestry Ecosystem Assessment & Management
- Geosciences & Geo-hazards,
- Marine & Atmospheric Science
- Water Resources
- Urban & Regional Studies,
- Satellite Image Analysis & Photogrammetry
- Geoinformatics

Third Module (Elective)

- Pilot project in the domain of Remote Sensing and GIS Technology applications in Natural Resources and Environment Management Planning and design of the project
- Literature survey
- RS data products Identification and acquisition
- Ground data collection and field verification
- Analysis and results
- Documentation and generation of report
- Project seminar
- Recommendation of a research area selected in home country for one year project.

* For details see Annexure I

PHASE II: ONE YEAR PROJECT

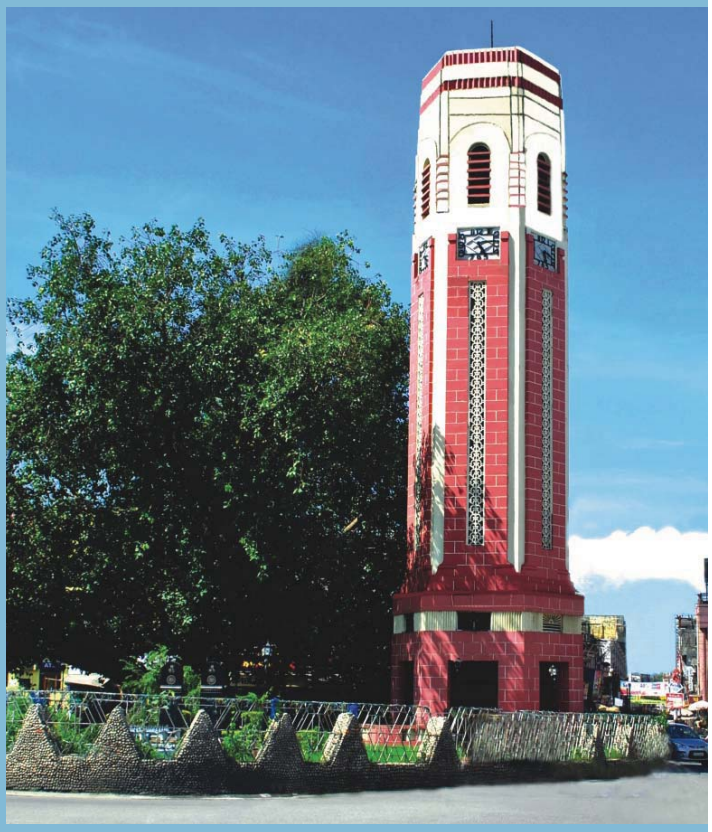
Each participant after completing Phase-I of the course, will have to carry out an approved project in his/her home country for a period of one year. This is to be formulated jointly by the scholar and his/her advisor at the Centre during Module 3 of Phase I in an area relevant to the interest of the sponsoring institution/country. The sponsoring institution/ country is obliged to guarantee on the return the

scholar would remain in a suitable position with commensurate and progressive remuneration and other entitlements for a minimum period of 3 years and will be provided all facilities to carry out the work. This course programme will be considered complete on acceptance/approval of the submitted project report.

ABOUT THE CITY

Dehradun city, often called as Doon Valley, is at the base of chain of one of tallest mountains in the world in Western Himalayas in northern India. It is one of the educational hubs in India. Weather is moderate during March to May. The hill station Mussoorie, the Queen of hills, is 30 km from here and experiences snowfall during winter. Fairly heavy monsoon rains (average annual rainfall 2000 mm) prevail during June to September. Winter is severe during the months of December to February (minimum temperature occasionally touches 1 to 2 degree Celsius). The valley has good greenery and is surrounded by dense tropical to temperate forests and pastures and provides pristine environment for academic pursuits. IIRS Campus is about 6 km from Dehradun railway station and about 30 kms from Jolly Grant Airport Dehradun. The place is well connected by train from New Delhi, Kolkatta (Calcutta), Mumbai (Bombay), Lucknow and by road from New Delhi. By air it is well connected with Delhi. Haridwar and Rishikesh, the two famous pilgrim centres are about 60 and 40 km, respectively from city. The Western Himalayas are well known for wonderful landscape, mountaineering, tracking, trails and river rafting.

Several important national organizations/institutions are located here. Some of important ones are: Indian Council of Forestry Research and Education, Indira Gandhi National Forest Academy, Forest Survey of India, Wildlife Institute of India, Survey of India, Oil and Natural Gas Corporation Limited, Central Soil and Water Conservation Research and Training Institute, Botanical Survey of India, Zoological Survey of India, etc. There are a large number of tourist places in and around the city.



Dehradun City

Alumni Meet

Alumni meets are organized to develop a network and to establish meaningful linkages between CSSTEAP, faculty and its past students. These are aimed to provide common platform to interact and apprise about the latest development in the space technology and its applications. Such meets were held in Nepal, Bangladesh, Sri Lanka, Bhutan and Myanmar in the past. The centre proposes to hold 2-3 such meetings in coming years in different countries with local support.

Participants of Short course on Small Satellite Missions

Annexure-I

Course Content

Subject	Major Topics (Theory)	Major Topics (Practical Exercise /Demonstration)
Module-IA		
1.1 Remote Sensing	Interaction between EM Radiation and matter; RS Systems Active & Passive, Imaging & Non Imaging Systems; Concept of Resolutions - Spatial, Spectral, Radiometric and Temporal; Orbits and Platforms for Earth Observation; Physical basis of spectral signatures of the objects; data reception & processing; image quality & structure, Thermal and Microwave remote sensing.	Study on spectral and image characteristics of optical, thermal & microwave aero-space RS data for characterization major earth features; Study on spectral signatures of objects using ground truth instruments - Radiometers, Spectrometers
1.2 Image Interpretation & Analysis	Principles of visual Interpretation of aerial photos and satellite imagery; Mathematical concepts mathematics & statistics used in digital image processing (DIP); Principles of DIP techniques rectification, enhancement, classification, feature selection & separability, image transformation, spectral indices, accuracy assessment, etc.	Visual interpretation of land cover details from aerial photograph and satellite images; DIP exercises - Image registration, Image enhancement & spectral indices; Image classification (supervised and unsupervised) & classification accuracy assessment
1.3 Photogrammetry	Basics of aerial Photography; stereoscopy & binocular vision; stereoscopic parallax; stereophotogrammetry; Analytical Photogrammetry- Collinearity and Co-planarity conditions, Concept of Rotation Matrix; Introductory concepts in Digital Photogrammetry; Satellite based Digital Photogrammetry; Concept of DEM, DSM and DTM, DEM extraction and Orthoimage generation	Stereoscopic interpretation of aerial photographs; Determination of heights using parallax bar; Familiarization with Digital Photogrammetry; feature extraction; Generation of DEM and orthoimage
1.4 Geoinformatics	Spatial Information System-overview; Hardware and Software requirements of GIS; Conceptual Model of Spatial & Non-Spatial Information; Spatial data Analysis (Vector & Raster based); network analysis; data quality & errors; Fundamental Concepts of GPS; Map projections, resource surveys, mapping & navigation, DEm, interpolation & DEM derivates; overview of spatial data infrastructure	Working with GIS software; Preparation and organization of spatial and non-spatial data in GIS; digitization & editing; Query & analysis; Spatial data analysis (Vector & Raster based); DEM; network analysis; Familiarization with different types of GPS receivers; area survey
Module-IB		
1.5 Recent Trends in RS and GIS & Environmental Assessment and Monitoring	Principles & applications of Hyperspectral & Laser RS, and SAR Interferrometry; Advances in DIP; Concept and approaches of Multi-criteria decision making; GIS customization concepts; Concepts & applications of Geostatistics; Satellite Meteorology; Concept of sustainable development & Integrated resource management for sustainable development; Global climatic change and its impact; Natural disasters- geological, environmental & hydro-meteorological; Biodiversity characterization & management; Urban and coastal zones monitoring and management; Watershed management	Advance DIP techniques e.g. Fuzzy, ANN, Expert system, Image Segmentation etc; SAR Interferrometry and its applications; Analysis of hyperspectral satellite data; GIS customization concepts; Concept and approaches of Multi-criteria decision making; Geostatistics.
Note: Semester-I (Module-IA & Module-IB) 4 months is common for all participants. Each participan has to appear for Theory & Practical examination in each paper (1.1, 1.2, 1.3, 1.4, & 1.5) & pass before entering in Semester-II.		
Module-II (optional electives, one to be chosen)		
2.1 Agriculture & Soils		
2.1.1 Land Use & Soil Resource Management	Concept & issues of sustainable agriculture; land use/land cover analysis; impact on biogeochemical & hydrological cycle; soil characteristics & pedogenesis; soil resource mapping; RS in soil survey & mapping; digital soil mapping; soil classification; soil morphology; soil taxonomy; land evaluation; land capability classification; soil & land irrigability; FAO framework of land evaluation; soil & land productivity indices	Agriculture land use mapping following visual and digital analysis; soil characteristics & analysis; soil classification; morphology characteristics; soil taxonomy; soil resource mapping; physiographic analysis; land evaluation
2.1.2 Agri-Informatics	Crop inventory & assessment; crop discrimination, acreage estimation, crop system analysis; crop management; precision agriculture; canopy reflectance modeling; microwave RS in crop inventory; ICT applications in agriculture; relational agri-database, retrieval of biophysical and socio-economic aspects; productivity contrast analysis; decision support systems	Crop identification, area estimation and condition assessment using digital techniques; crop condition & stress; Demonstration on use of Hyderspectral data in crop inventory; SAR data analysis; SDSS for crop input optimization.

Subject	Major Topics (Theory)	Major Topics (Practical Exercise /Demonstration)
2.1.3 Environmental Soil Science	Land degradation; factors, processes & RS use; Watershed characterization, delineation codification & management; soil erosion, conservation, monitoring and impact; soil quality indicators, measurement & assessment; soil carbon sequestration, soil biogeochemical cycle, soil pollution, soil nutrient management and impact of climate change on soil processes; Optimal land use planning; agro ecological characterization; land evaluation methods; FAO-AEZ based land use planning	Digital analysis of degraded land mapping; GIS applications for soil erosion inventory & modeling; Land evaluation and suitability analysis; Watershed analysis-prioritization and soil conservation planning; soil erosion modeling; MCA approach for agricultural land use planning; soil quality indicator, variability analysis.
2.1.4 Satellite Agrometeorology	Agro-meteorology for sustainable agriculture; agrometeorological factors & considerable for sustainable agriculture; Agrometeorologcal parameters retrieval from satellite; crop yield modeling & production forecasting; integrating RS & crop growth models; regional crop production assessment & forecasting; global energy balance & early warning system; Land surface climatology; impact of climate change and variability on agriculture; climate change mitigation and adaption strategies	Drought & rainfall climatology analysis; surface temperature, rainfall, biophysical parameter estimation from satellite; regional evapotranspiration; crop water requirement; crop yield estimation from satellite; climate change impact on crop productivity; eddy covariance measurements & simulation of energy water & CO2 exchange
2.2 Forest Ecosystem Assessment & Management		
2.2.1 Forest Mapping & Monitoring	Forest mapping, distribution, types, status & classification; Spectral properties of vegetation & spectral indices; Visual and digital analysis of satellite image for forest cover type mapping; Forest change, growth, green wave & Insect pest damaged forest detection; hyperspectral and Microwave RS in forestry, LiDAR RS for tree height determination; biophysical spectral response based forest canopy density mapping	Forest mapping & density assessment using RS data using visual & digital techniques; Forest cover change detection; hyperspectral, Microwave and LiDAR interpretation techniques
2.2.2 Forest Inventory	Principle of forest inventory; Sampling theory & design; Forest mapping & density assessment using RS data; Stock mapping for preparation of forest management plan; Forest cover change detection; growing stock, biomass & carbon estimation; statistical data analysis; Fuel wood and fodder resource assessment; Use of optical, radar & Lidar in growing & biomass assessment	Measurement of tree height and crown density; Forest sampling techniques; Growing stock estimation; statistical data processing and geostatistical analysis & modelling
2.2.3 Forest Informatics	Modelling approaches in forestry; Geoinformatics for Forest working plan; Fire ecology, detection, risk assessment & modeling; Geo-spatial technology for wild life habitat; protected areas, habitat suitability models & modeling; Forest degradation assessment and monitoring	Site suitability analysis for forestry; Revision and updating of stock maps; GIS database creation for forest management; Forest fire risk modeling; Wild life habitat analysis; forest degradation assessment
2.2.4 Forest Ecosystem Analysis	Forest ecosystem principles & concept; Landscape & ecosystem analysis; Biodiversity characterization at landscape level; Forest, environment & climate change impacts on forest & biodiversity, habitats; environmental policy & strategy; Environmental impact assessment (EIA); Wetland monitoring & conservation planning; biodiversity conservation planning	Landscape analysis; phtosociological analysis; biomass, productivity assessment; vegetation cover prediction modeling; biodiversity characterization; EIA case study
2.3 Geosciences & Geo-hazards		
2.3.1 Remote Sensing for Earth & Planetary Sciences	Satellite image interpretation in Lithological and structural analysis; Geological Interpretation of Thermal & Microwave Remote Sensing Data; Hyperspectral Remote Sensing for lithological mapping & mineral exploration; RS and GIS in Oil & Mineral Exploration; RS for hydrocarbon exploration- hydrocarbon resources, model of occurrence & indicators; mapping geological & geomorphological anomalies related to petroleum occurrences; overview, RS of planetary missions	Geological Mapping, spectral analysis using Satellite Imagery; Geological applications of RS data in mineral and oil explorations; Geological Interpretation of Microwave RS data, planetary missions
2.3.2 Data processing & Analysis for Geosciences	DIP for geological applications; Landform analysis based on satellite data Interpretation; hyperspectral & microwave data processing for mineral, alteration zone, terrain mapping, crustal deformation & land subsidence; Geodatabase, creation, geospatial analysis, output generation, DTM and 3D data handling for geological applications & watershed analysis; Applied statistics & geostatistics	Geomorphological Mapping; hyperspectal and MW image analysis for mineral, DEM, crustal deformation and land subsidence studies; data fusion & change detection for surface change analysis; geological database organization, spatial analysis, terrain analysis & terrain parameter extraction; multivariate statistics

Subject	Major Topics (Theory)	Major Topics (Practical Exercise /Demonstration)
2.3.3 Applied & Tectonic Geomorphology	Geomorphic processes & landform evolution; tectonic geomorphology, ative tectonics, neotectonics, earthquake geology, land system analysis; applied geomorphologic mapping; geomorphic classification systems; climate tectonic relationship and landform dynamics	Geologic and Geomorphic Interpretation; Fluvial landform mapping & analysis; Glacier & snow cover mapping, snout position identification, glacier landform mapping; tectonic landform mapping and analysis; applied geomorphological mapping
2.3.4 Engineering Geology & Ground Water	Engineering geology & mass movement types, classifications of landslides & modeling; Engineering geological site investigations and environmental impact assessment of dams & reservoir; Principles of RS in hydrogeological mapping and groundwater exploration; RS & GIS in ground water exploration and management in hard rock/unconsolidated material; Groundwater Management, Artificial Recharge and Rain Water Harvesting; Groundwater quality	Engineering geological mapping using RS data; landslide hazard zonation & risk analysis; route alignment, suitable site selection for dam/reservoir, catchment & rim area analysis; RS for Construction material investigations and estimation of rock mass strength; Erosion and Mass Movement Processes; Highway Alignment Studies & geologic hazards; RS & GIS for groundwater exploration; Interpretation of hydrochemical data & ground water quality zonation
2.4 Urban & Regional Studies		
2.4.1 Fundamentals of Urban & Regional Planning	Concept of settlement planning; town planning practices; urban & regional planning models; preparation of development/master/ zonal plans; image interpretation of urban areas; urban land use planning; urban land use classification system; accuracy assessment; base map and cadastral maps for urban areas; photo-maps; ortho-maps; foot print map; RS & GIS for property tax assessment	Identification of urban objects using satellite images on different scales; interpretation & delineation of urban areas; Population estimation; Urban growth monitoring; urban LU/LC classification system;
2.4.2 Geo-Spatial technologies in Urban Area Analysis	Urban sprawl; slum & squatter analysis; census operation & population studies; population estimation through RS; concept of space use; techniques of space use mapping; quantitative techniques for urban analysis; techniques in human geography; analysis of spatial data; structuring spatial relationships	Urban sprawl mapping; census updating & population estimation techniques; space use mapping; supervised & un-supervised classification of urban areas, various statistical techniques of data analysis
2.4.3 Urban Resources, Services and Facilities Analysis	Geo-spatial technologies for urban utility mapping; solid waste management; urban hydrology, water supply etc; urban hazard & risk assessment; urban geomorphology for hazard identification; multi-risk assessment; damage assessment due to earthquake, fire & explosion; traffic & transportation studies; geo-spatial technologies in route alignment studies; urban resources studies; spatial distribution of resources; urban energy consumption & sustainability	Facility mapping & buffer analysis; network analysis; urban hazard mapping, analysis & risk assessment; traffic & parking survey & inventory
2.4.4 Geo-Spatial Technologies for Urban Environmental Studies	Object based image analysis for urban areas; virtualizing of 3D real world for urban designs; ANN for modeling urban growth; mobile mapping, ALTM, LiDAR for urban surface modeling; concept of CA in urban growth studies; Climate change, diseases & human health; urban heat island; urban microclimate, urban pollution, urban forestry, multi-criteria techniques in land evaluation & suitability analysis; urban & village information system	DEM generation, mobile mapping & updating maps; urban plan monitoring & change detection; urban noise survey, mapping & analysis; U.I.S & web GIS design & implementation, village resource centre programme
2.5 Marine & Atmospheric Science		
2.5.1 Coastal Processes & Marine Ecology	Elements of coastal geomorphology & visual interpretation of satellite image; RS application of coastal land form sedimentation, erosional & depositional processes; retrieval of coastal bathymetry from optical & SAR data; coastal & esturine dynamics, near shore circulation pattern, coastal hazards predictions, tsunami, sea level rise; elements of oceanic eco-system, bio-pyramids pelagic, non-pelagic, benthos, beach & sub-tidal ecology, coastal wetland, mangroves , corals & marine ecology; biogeochemical cycles	Visual and Digital analysis of satellite data in mapping costal landforms; Coastal landform analysis and mapping shoreline changes; Coastal zone density measurement; circulation pattern, bathymetry, suspended sediment analysis etc; biogeochemical cycle model
2.5.2 Atmosphere & Ocean Dynamics	Atmosphere structure & composition, atmospheric circulation & climate, ocean structure & composition, radiation & heat budget; governing equations, atmosphere & ocean; tropical dynamics, large scale tropical circulations, equatorial wave theory etc, ENSO & Indian monsoon	Rainfall data analysis; atmospheric dynamics, ocean dynamics

Subject	Major Topics (Theory)	Major Topics (Practical Exercise /Demonstration)
2.5.3 Satellite Oceanography	Principles of ocean RS; visible RS of ocean; retrieval of phytoplankton, suspended sediment conc. yellow substance, coastal bathymetry; thermal, MW RS of ocean; retrieval of various parameters from thermal and MW data; active MW RS and understanding retrieval of parameters; satellite scatterometery of sea surface winds; satellite altimetry of sea-surface topography; principle & return wave form analysis	Computation of in situ underwater optical data; retrieval & analysis of sea surface temperature from thermal and MW data; altimeter wave form analysis; retrieval of wind field from scatterometer observation
2.5.4 Satellite Meteorology	Principles of atmospheric RS; Meteorological satellite instrumentation & image interpretation; earth radiation budget etc; interferometer, limb scanner, MW imager etc; Retrieval of temperature, trace gases, ozone and winds; retrieval of aerosols and precipitation; measurement of earth radiation budget	Satellite imagery interpretation for meteorological phenomena; retrieval of ozone, rainfall, aerosol optical depth etc
2.6 Water Resources		
2.6.1 Water Resources Assessment	Hydrological cycle & its components, concept of watershed, RS & GIS applications in hydrology, quantification of hydrological elements; surface water & quality, spectral signature, RS in water quality analysis; Spectral Characteristics of Water, Snow and Surface Water Inventory; Hydrologic Elements and Quantification through RS; Snow Hydrology- Snowmelt Runoff Modelling and glacier Inventory; water Balance components & computation	Watershed delineation; stasticial & spatial analysis of precipitation using RS; rainfall, soil moisture, ET retrieval; surface water body mapping & water quality analysis; snow cover area mapping, snow melt runoff modeling; climatic water balance components
2.6.2 Watershed Analysis & Planning	Watershed hydrology; Terrain indices for water resources applications; DEM derivatives; soil erosion processes & modeling, sediment yield modeling using empirical & process based models; watershed prioritization & conservation planning; urban hydrology, water distribution system & modeling, RS & GIS in urban hydrological process	Watershed characterization, morphometric analysis & GIUH derivation; DEM generation from optical and InSAR techniques; soil erosion modeling; watershed conservation planning using RS & GIS; urban hydrological modelling
2.6.3 Water Resources Development	Site suitability for water resource projects; water harvesting structures, database required and decision rules; EIA of river valley projects; Irrigation infrastructure development, performance evaluation & conjunctive water use planning; water logging & salinity in irrigation command; ground water targeting & modelling	Database creation & identifying suitable sites for WHS, hydro power projects using RS & GIS; EIA of river valley projects; irrigation command area mapping; crop water requirement calculation; mapping and monitoring of waterlogged & saline areas; ground water targeting & modelling
2.6.4 Water Resources Management	Reservoir sedimentation, suspended sediments, sedimentation rate through RS; flood hydrology damage assessment & risk zone mapping; flood inundation mapping & modeling; drought monitoring & assessment; climate change scenarios- dynamic & statistical & water resources; glacier retreat & glacial lake mapping; modeling of climate change scenarios & scaling issues; integrated water resources management	Monitoring of reservoir sedimentation; flood peak flow estimation; hydrologic modeling & flood flow estimation; flood inundation, flow mapping & modeling; drought assessment; analysis of hydro-meteorological parameters; glacier retreat mapping & hydrological modeling for climate change scenarios
2.7 Satellite Image Analysis & Photogrammetry		
2.7.1 Remote Sensing-II	Hyperspectral RS; noise & data dimensionality reduction; data quality; Radiometric & Atmospheric corrections for multispectral & hyperspectral sensors; concepts of radiative transfer theory; retrieval of biophysical parameters; space based thermal imaging system; retrieval of geo-physical parameters using thermal sensors; meteorological sensors in atmospheric sounding, meteorological parameters	Retrieval of geo-physical parameters using thermal data; radiative transfer modeling; atmospheric correction of hyper-spectral & MSS data; spectral library creation; end member selection & classification; ground data collection
2.7.2 Image Processing-II	Advanced classifier- fuzzy classification, ANN & classification methods; image segmentation & objected oriented classification; automatic feature extraction; automatic extraction of deterministic objects	Fuzzy & ANN Classifications ; Multi resolution segmentation of Image objects; Texture Analysis and Texture based segmentation; automatic linear feature extraction
2.7.3 Digital Photogrammetry and Mapping	Conventional survey techniques, Geodesy, integration from different sources for large scale mapping; GNSS, mobile mapping; Aerial & satellite Photogrammetry; data processing for stereo generation, ortho-rectification; Digital cartography, 3D simulation, visualization & terrain analysis	Ground survey; GCP collection, processing & data integration; stereo restitution of satellite images, feature extraction in 2D & 3D mode; digital cartography, digital earth model

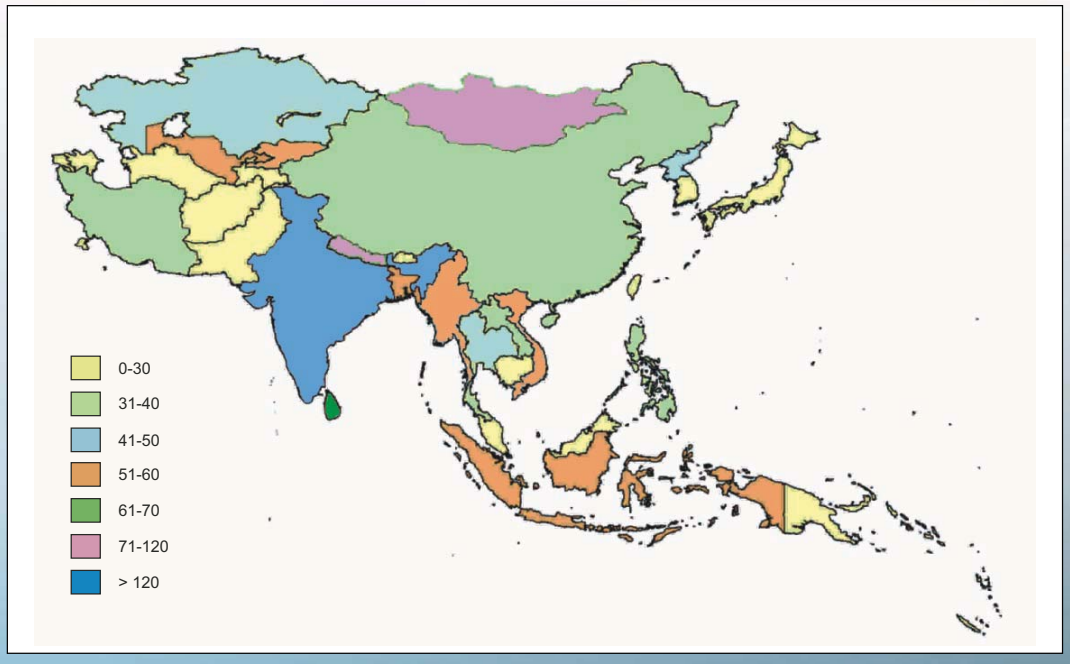
Subject	Major Topics (Theory)	Major Topics (Practical Exercise /Demonstration)
2.7.4 Surface Generation Techniques	DSM generation; limitations of photogrammetry extraction using optical data & alternatives; close range photogrammetry, data processing surface generation; SAR & differential interferometry, processing, analysis and accuracies; SAR polarimetry; Laser RS, concepts, extraction from point data & waveform processing	Interferometric processing for DEM generation; polarimetric SAR data processing; LiDAR wave form data processing; filtering & elevation information; close range photogrammetry
2.8 Geoinformatics		
2.8.1 Spatial database Architectures & modeling	Database overview; spatial databases, types & structures; conceptual data modeling, UML, database design & topology relationship; spatial database storage & retrieval; Geospatial modeling & its classification, decision modeling concepts, decision support systems, agent based modeling & its applications	Spatial database creation, design, schema creation; file storage, data type insertion & retrieval, spatial queries, optimization & index creation; multi criteria decision modeling & agent based modeling
2.8.2 Programming in Geodata modeling	Basics programming concepts, expressions, statements, conditionals & iterations; data structure and object oriented programming; open source programming APIs; scientific plotting, database connectivity, imaging library; KML parsing API, geodata abstraction library; customizing open source GIS software	Familirization of programming language, variables & functions; data structure & object oriented programming; Matplotlib & Python imaging library, KML parsing, python library
2.8.3 Web GIS and Geovisualization	Internet technology & Web GIS; internet GIS, networking, protocols & client/server architecture; web programming; distributed GIS; service oriented architecture, interoperability & standards; web GI services, OGC standards, open GIS, map servers, OGC, WMS & WFS,KML, cloud computing; Geo-visualization exploration; 3D topology	Internet GIS; web designing; server side scripting; open source geo- network metadata cataloguing system; creation & dissemination of OGC WMS & WFS services, Google & Bhuvan APIs; visualization of 3D geospatial data & creation of 3D models
2.8.4 Spatial Data Quality and Geostatistics	Concepts of probability & statistics, regression & least squares, quality & fitness of measurement data; uncertainty & its quantification; Atrribute & positional uncertainty, sources, precision; Error & uncertainty propagation, taylor series approprixation, uncertainty cascade, error models, systematic error & model uncertainty; spatial variation models & dependence measures; spatial sampling and modeling; Modeling the variogram, Ordinary Kriging, Universal Kriging; Co-Kriging , Indicator Kriging	Exploratory data analysis, probability & statistics, regression & least squares; image generation at varied spatial resolutions; Taylor series expansion, error & uncertainty modeling & propagation; modeling spatial structure from point samples, assessing quality of spatial predictions; variogram, semi-variogram; geostatisticsl estimation using kriging, universal kriging & block kriging

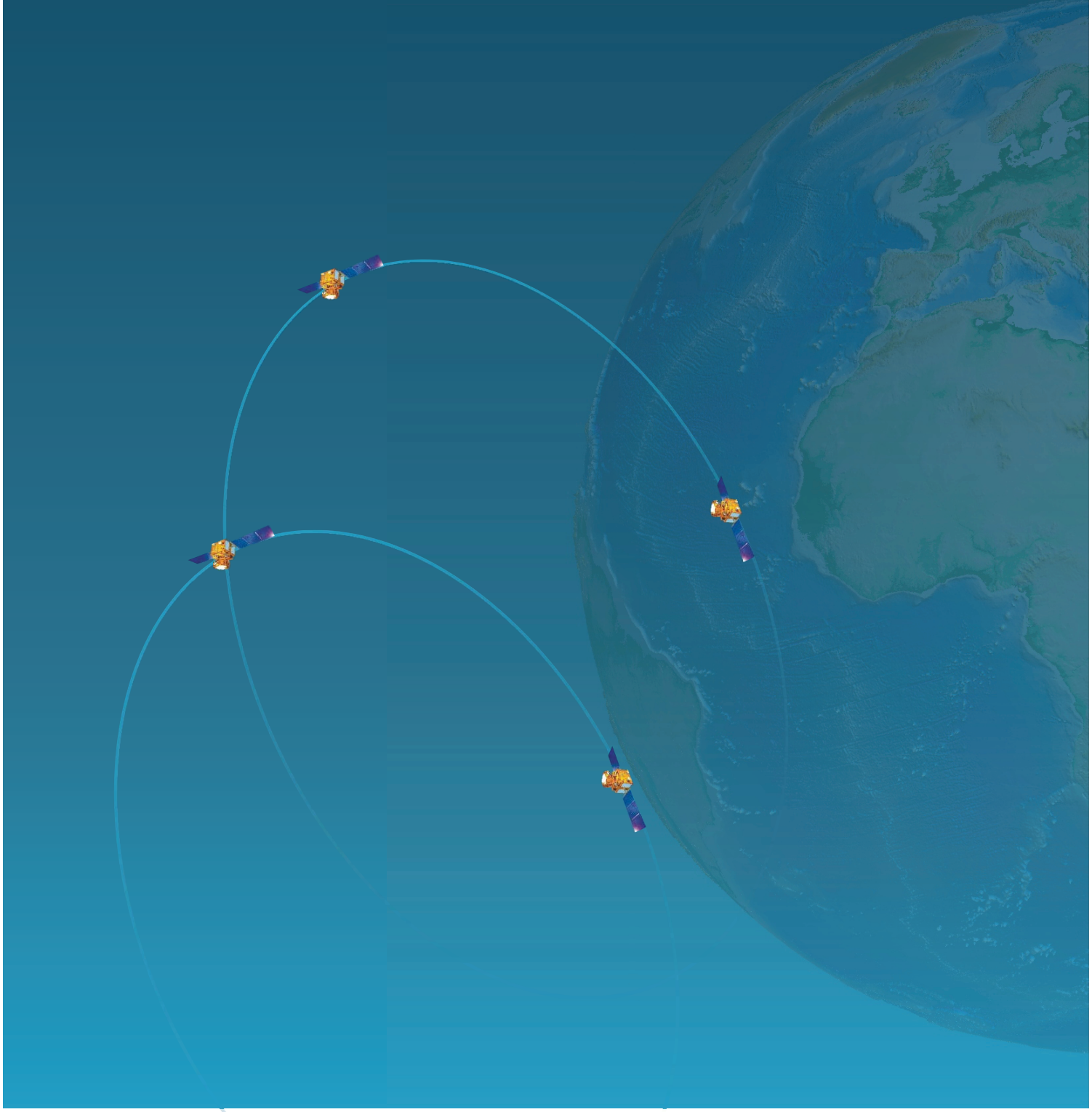
Note: Semester-II consists of Module -II (2 months) & Pilot project (3 months). Each participants has to choose one elective subject (out of 8 electives mentioned above). The Pilot project has also to be carried out in that subject only. Each participants has to appear for Theory & Practical examination in each paper (4 papers in Module-II) & pilot project defense. On successful passing of all exams & completion of pilot project the candidate will be awarded Post Graduate Diploma Certificate. **Once a candidates choses an elective, he/she will not be allowed to change in the middle of Semester-II.**

CSSTEAP

Inaugural Function of 19th RS & GIS PG course

Countrywise output from CSSTEAP programme





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