



# REMOTE SENSING ESSENTIALS

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**PRE-REQUISITES :** Remote Sensing / Geoinformatics companies, e.g NIIT, ESRI India, Leica Geoinformatics, MapmyIndia etc

**INTENDED AUDIENCE :** Under- / Post-graduate engineering and post graduate science students / PhD candidates

**INDUSTRIES APPLICABLE TO :** ONGC, OIL, GSI and others

## **COURSE OUTLINE :**

The proposed course provides basic understanding about satellite based Remote Sensing and Digital Image Processing technologies. Presently, remote sensing datasets available from various earth orbiting satellites are being used extensively in various domains including in civil engineering, water resources, earth sciences, transportation engineering, navigation etc. Google Earth has further made access to high spatial resolution remote sensing data available to non-experts with great ease. Knowledge of Digital Image Processing of satellite data allows to process raw satellite images for various applications.

## **ABOUT INSTRUCTOR :**

Prof. Arun K. Saraf is Ph. D. (Remote Sensing) from University of Dundee, United Kingdom. Presently he is working as Professor in the Department of Earth Sciences, Indian Institute of Technology, Roorkee, and teaches courses on Remote Sensing, Digital Image Processing, Geographic Information Systems (GIS), Advanced GIS, Geomorphology, Geohydrology etc. to under- and post-graduate students of Geological Technology and Applied Geology. He was also Head of Department of Earth Sciences between Jan. 2012 Feb. 2015. He was first in the country to introduce GIS course to post-graduate students in the year 1990. In 1986, he was awarded National Fellowship to Study Abroad by Govt. of India for his doctoral degree. Further, in 1993 he was awarded Indo-US S&T Fellowship and worked in Goddard Space Flight Centre, NASA, USA for Post-Doctoral Research. He has been also awarded National Remote Sensing Award- 2001 by Indian Society of Remote Sensing and GIS Professional of the Year Award-2001 by Map India 2002 for his outstanding research contributions in the fields of Remote Sensing and GIS. Earlier, he has also been given several Khosla Research Awards and Prizes by then University of Roorkee. So far Prof. Saraf has published more than 100 research papers in journals of repute (ISI) and supervised 11 Ph.Ds. He was also Associate Editor of International Journal of Remote Sensing during 2003-2015. Through funding from DST, Min. of Earth Sciences, CSIR, Prof. Saraf has been able to establish and operating NOAA-HRPT Satellite Earth Station at IITR since Oct. 2002, first in any educational institute in the country. This Earth Station is still operational and acquiring data from NOAA-18 & 19 day-and-night. In recent past, Prof. Saraf has also recorded four courses viz. Introduction to Geographic Information Systems, Introduction to Remote Sensing, Digital Image Processing of Satellite Data, Digital Elevation Models and Applications and Global Navigation Satellite Systems under the NPTEL scheme.

## **COURSE PLAN :**

### **Week 1 :**

Rudiments of remote sensing and advantages,  
Historical Perspective of development of remote sensing technology,  
EM spectrum, solar reflection and thermal emission,  
Interaction of EM radiation with atmosphere including atmospheric scattering, absorption and emission,  
Interaction mechanisms of EM radiation with ground, spectral response curves

### **Week 2 :**

Laws of Radiation and their relevance in Remote Sensing,  
Basis of remote sensing image representation,  
Various Remote Sensing Platforms,  
Multi-spectral scanners and imaging devices,  
Significant characteristics of LANDSAT, SPOT, Sentinel sensors

**Week 3 :**

Prominent characteristics of IRS, Cartosat, ResourceSat sensors, Unmanned Aerial Vehicle / Drone, Passive Microwave Remote Sensing, Image characteristics and different resolutions in Remote Sensing, Different techniques of Image acquisition

**Week 4 :**

Importance of digital image processing, Digital Image Processing Software, Basic image enhancement techniques, Colour representations and transforms, Image Histograms and statistics

**Week 5 :**

Atmospheric errors and corrections, Georeferencing Technique, Digital Image Processing Software – Demonstration-1, Image enhancement techniques –I, Image enhancement techniques –II

**Week 6 :**

Digital Image Processing Software – Demonstration-2, Spatial Filtering Techniques, Band rationing and PCA, Frequency Domain Fourier Transformation, Digital Image Processing Software – Demonstration-3, Unsupervised image classification and density slicing techniques

**Week 7 :**

Supervised image classification techniques and limitations, Digital Image Processing Software – Demonstration-4, LiDAR Technique and applications, Mosaicking, subsets, sub-sampling techniques and applications, False Topographic Phenomena and correction techniques-01

**Week 8 :**

False Topographic Phenomena and correction techniques-02, High Spatial Resolution Satellite Images and limitations, Basic Image Compression techniques and different image file formats, Hyperspectral Remote Sensing, Digital Image vs Digital Photograph

**Week 9 :**

NDVI and other indices, Active Microwave Remote Sensing-01, Active Microwave Remote Sensing-02, Radar Images interpretation and applications, SAR Interferometry (InSAR) Technique-01

**Week 10 :**

SAR Interferometry (InSAR) Technique-02, Principles of image interpretation, Image interpretation of different geological landforms, rock types and structures, Remote Sensing of Moon and Mars, Google Earth and its Applications

**Week 11 :**

Integrated applications of RS and GIS in groundwater studies-01, Integrated applications of RS and GIS in groundwater studies-02, Applications of Remote Sensing in Earthquake Studies-01, Applications of Remote Sensing in Earthquake Studies-02

**Week 12 :**

Different sources of free satellite images, Limitations of Remote Sensing Techniques