4.4 REMOTE SENSING IN ENGINEERING GEOLOGY

Every object on earth emits its own internal energy according to its molecular and atomic structure, in addition to reflecting sun light during the day time. This radiations can be registered by sensors in several wavelengths, including those in the infrared and microwave regions of the spectrum. When such sensors are installed on aircrafts or on satellites they can record the earth's objects from for off distances. Such distant (Remote) acquisition of information about the objects on the earth's surface is known as remote sensing.

Aerial Photography & Imageries:

The photographs of the earth taken from aircrafts are called the aerial photographs, while the pictures taken from the satellites are called the imageries.

Aerial Photographs:

Aerial photographs of the region are taken by cameras placed in the aircrafts. Aerial photos give three dimension of the photographed area. These photos contain a detailed record of the ground at the time exposure.

Satellite Imageries:

The satellite imageries can either be read manually like aerial photographs, or with the help of computers.

Geographic Information System;

The modern computers can process maps and data with suitable computer programmer. The process of integrating and analyzing various types of data with the help of computer is known as geographic information system.

Applications of Remote Sensing:

The applications of remote sensing are general geological mapping, mineral prospecting, petroleum exploration, groundwater exploration, and engineering, uses of site rocks, disaster studies and also coastal geological studies.

Geological Considerations Involved In the Construction of Buildings

Basic requirements of a building foundation, building foundation on soils, building foundation carried to the deep hard rocks, building founded on surface bed rocks, types of settlement in buildings.

Air Photos:

Air photos have shape and size, flight and photo data, scale.

Kinds of Air Photos:

Vertical air photos, oblique air photos, anusaics, photo strips, and stereo rain.

Stereo Meter:

The instrument is used under a mirror stereoscope for measuring heights and areas ofobjects from air photos.

Components of remote sensing

There are seven basic components of remote sensing. They are:

A – Energy source or illumination

B – Radiation and the atmosphere

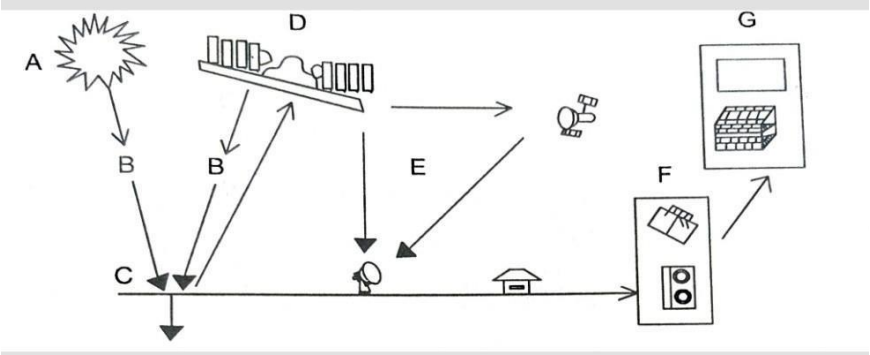
C – Interaction with the target

D – Recording of energy by the sensor

E – Transmission, reception and processing

F – Interpretation and analysis

G - Application



REMOTE SENSING TECHNIQUES

Remote sensing is the science, art and technology of obtaining information about the object, through the analysis of data acquired by a device this is not in contact with the object under the investigation. Various objects are identified with the help of variationin the reflected electromagnetic radiation reflected by different earth's objects. A remote sensing system, therefore, must be sensitive enough to capture the changes inthe reflected electromagnetic energy. An ideal remote sensing may have the following components. Source of electromagnetic energy Medium which interacts with this energy Ground objects Sensor to detect and record the changes in electro-magnetic energy Electromagnetic radiation: Sun is the source of light. It radiates the heat and light energy in the form of electromagnetic radiation, the EMR comprises various rays such as, X- rays UV,

Visible, Infrared, thermal inferred, microwave and radio wave. , X- rays and UV are observed and reflected by upper layer of atmosphere, which is most useful for remote sensing hence it is known as atmosphere window.

The part of the electromagnetic radiation from visible to microwave is called electromagnetic spectrum (EMS).

Principle:

- Various components of an electromagnetic spectrum with their wavelength and frequency are shown in the above figure.
- All objective on the earth reflective absorb or radiate energy in the form of electromagnetic waves coming directly from the sun.

- The electromagnetic radiation (EMR) reflected from the objective is transmitted through the atmosphere. The remotely placed sensors can pick up the transmitted energy, record and form an image.
- This image data is sent to the earth recording stations, where all the data is recorded on high density digital tapes.
- Information about an object depends upon its spectral characteristic, which itself depends upon the nature of the object and its environment.
- The electromagnetic radiation travelling through the atmosphere gets modified by absorption and or scattering.

Remote sensing plate form:

- Plate form is defined as a stage of sensor or camera. They play vital role in remote sensing data acquistation.
- They are necessary to correctly position the sensors that collect data from the objects of interest.
- The platforms may be air-borne, or space-borne, depending upon the objects under study on earth surface and also on the sensor employed. Balloons, Aircraft, and Satellites are the common remote sensing platform.

Balloons: These are designed and used for specific projects. Through the use of balloon is commonly restricted by meteorological factors, there application in resource mapping has been significant useful. Balloons are usually of two types, a) Free balloons and b) Threaded balloons.

Aircraft: aircraft are commonly used as remote sensing plate forms for obtaining aerial photographs.

They considered useful for regional converge and large scale mapping.

Space born plate form:

- Satellite has provided to be vital use in natural resource mapping, meteorological and communication application applications.
- Satellites are free- flying orbiting vehicles, whose motion is governed by the gravity, and atmosphere based on well-known Kepler's laws.
- Broadly, satellites can be grouped under two categories depending upon the types

of orbits in which they move.

Geostationary satellite

Altitude - 35,000km

Orbital Movement - Parallel to Earth Rotation

Uses - Communication

Example - GOBS, GMS, INSAT etc

Sun-Synchronous or Polar orbiting satellite

Altitude - 800-900km

Orbital Movement - Pole to Pole

Uses - Earth Observation

Example - LANDSAT, SPOT, IRS, IKNAS, QUAKE BIRD etc

Sensor system:

- In remote sensing, the acquisition of data is dependent upon the sensor system used. Various remote sensing platforms are equipped with different sensor systems.
- It is a device that receives electromagnetic radiation, converts it into a signal and presents it in a form suitable for obtaining information about the land or earth resource as used by an information gathering system. Sensor can be grouped, either on the basis of energy source or on the basis of wave bonds employed. Based on the energy source, sensors are classifies as follows.

Sensor Classification

Based on the energy source Sensor May be classifies in to the followings:

- Active Sensors (Sensor which produce the EMR by its own i.e RADAR)
- Passive Sensors (Sensor depends the suns EMR i.e., MSS, TM, XS, LISS, PAN, WiPS etc)
- Passive Sensor further divided into number of following types based on function of sensor in EMR>
- Photographic Camera (Operated in single band from 0.4-0.7mm)
- Return Beam Vidcon (Operated in Green, Red, NIR)- RBV in Landsat and TV in Bhaskara

- Thermal Sensor (Operated in Thermal Infrared Region)
- Optical and Mechanical Sensors (Operated in 0.5-1.1 mm) MSS and XS Radar and Microwave Sensor (Operated in Microwave Region) SLAR, SAR
- Advanced Remote Sensor (Operated in GBR and IR) LISS-II, LISS-III, LISS-IV, WiPS, PAN,

TM Parameter of sensor:

- **Spatial Resolution**: The minimum detectable area on the ground by a detector placed on a sensor
- **Spectral Resolution:** The small amount of spectral changes is detected by the sensor.
- **Radiometric Resolution**: The presence of grey level
- **Temporal Resolution**: Smaller period of repetitive coverage
- **Remote Sensing Satellite**: Remote sensing, as conceived today for natural resource mapping was started with the launching of the first earth resource.
- Technology's satellite (ERTS) now known as LANDSAT-1, by USA in 1972 since then, with the advancement in sensor technology, a number of remote sensing earth resource satellite have been launched. The important milestones crossed so far in achieving end-to-end capability are LANDSAT Series, 1, 2, 3, 4, 5, 6 and 7; Frances satellite 1, 2,and 3, Indian polar satellite Bhaskara 1&2, IRS 1A/ IRS 1B/IRS 1C/IRS 1D/IRS P2/IRS P3/IRS P4/IRSP5/IRS P6& Indian meteorological satellite INSAT 1A/1B/1C/1D and 2A/2B/2C/2D/2E etc.,