19AGT302- GIS AND REMOTE SENSING

UNIT – I:

PART A (2 MARKS)

1. What is Remote Sensing?

Remote sensing is the science and art of obtaining information about on object, area, or phenomena through the analysis of data acquired by a device that is not in contact with the object, area, or phenomena under investigation.

2. What is the application of Remote Sensing?

In many respects, remote sensing can be thought of as a reading process. Using various sensors, we remotely collect data that M/J be analyzed to obtain information about the objects, areas, or phenomena being investigated. The remotely collected data can be of many forms, including variations in force distributions, acoustic wave distributions, or electromagnetic energy distributions.

3. Write the physics of Remote Sensing.

Visible light is only one of many forms of electromagnetic energy. Radio waves, heat, ultraviolet rays, and X-rays are other familiar forms. All this energy is inherently similar and radiates in accordance with basic wave theory. This theory describes electromagnetic energy as traveling in harmonic, sinusoidal fashion at the "velocity of light" c. The distance from one wave peak to the next is the wave length ψ, and the number of peaks passing a fixed point in space per unit time is the wave frequency V.
From basic physics, wave obey the general equation C = v y

4. What are the components of Remote Sensing?

a. The energy sources
b. Atmosphere
c. Energy-matter interaction
d. The sensors
e. Data processing and supply system
f. Multiple data users.

5. What is Electro Magnetic Radiations?

Electromagnetic (EM) radiation is a self-propagating wave in space or through matter. EM radiation has an electric and magnetic field component which oscillate in phase perpendicular to each other and to the direction of energy propagation.

6. What is the significance of EMR in remote sensing?

EMR stands for electromagnetic radiations. It is the energy emitted reflected from ground features and transmitted to the sensing instrument in the form of waves. This emitted energy/radiant energy is called electromagnetic radiation. The remote sensing of land surface features is based on detection of electromagnetic radiation. The water vapour. Oxygen, ozone, CO_2 etc present in the atmosphere influence EM radiation through the mechanism of 1. Scattering 2. Absorption.

7. What are the types of Electromagnetic radiation?

Electromagnetic radiation is classified into types according to the frequency of the wave, these types include (in order of increasing frequency): radio waves, microwaves, terahertz radiation, infrared radiation, visible light, ultraviolet radiation, X-rays and gamma rays.

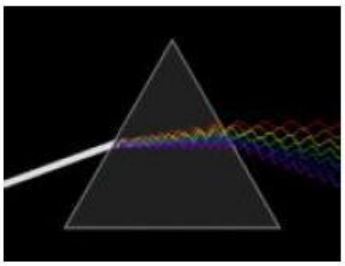
8. Draw the quantum theory interaction.

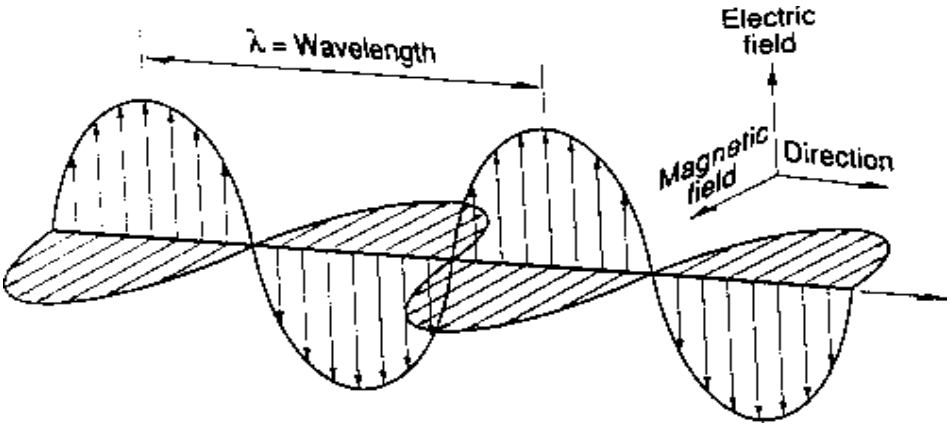
A quantum theory of the interaction between electromagnetic radiation and matter such as electrons is described by the theory of quantum electrodynamics.

9. Explain refraction.

In refraction, a wave crossing from one medium to another of different density alters its speed and direction upon entering the new medium. The ratio of the refractive indices of the media determines the degree of refraction, and is summarized by Snell's law. Light disperses into a visible spectrum as light is shone through a prism because of refraction.

10. Draw the Wave model.





11. Write plank's equation.

The frequency of the wave is proportional to the magnitude of the particle's energy. Moreover, because photons are emitted and absorbed by charged particles, they act as transporters of energy. The energy per photon can be calculated by Planck's equation: where E is the energy, h is Planck's constant, and f is frequency.

12. What is black body?

By definition a black body is a material that absorbs all the radiant energy that strikes it. A black body also radiates the maximum amount of energy, which is dependent on the kinetic temperature.

13. Write Stefan Boltzmann law.

According to the Stefan-Boltzman law the radiant flux of a black body, Fb, at a kinetic temperature, Tkin, is Fb = s* Tkin

4 where s is the Stefan- Boltzman constant, 5.67*10-12W*cm-2*°K-4.

14. What is emissivity?

Emissivity is a measure of the ability of a material to both radiate and absorb energy. Materials with a high emissivity absorb and radiate large proportions of incident and kinetic energy, respectively (and vice- versa).

15. Write Wien s displacement law.

Which the maximum amount of energy is radiated, which is expressed as lmax. The sun, with a surface temperature of almost 6000°K, has its peak at 0.48mm (wavelength of yellow). The average surface temperature of the earth is 290°K (17°C), which is also called the ambient temperature; the peak concentration of energy emitted from the earth is at 9.7mm.This shift to longer wavelengths with decreasing temperature is described by Wien"s displacement law, which states: lmax = 2,897mm°K /Trad°K

16. Short notes on Planck s law.

The primary law governing blackbody radiation is the Planck Radiation Law, which governs the intensity of radiation emitted by unit surface area into a fixed direction (solid angle) from the blackbody as a function of wavelength for a fixed temperature. The planck Law can be expressed through the following equation.

17. Write short notes on Scattering.

Scattering occurs when particles or large gas molecules present in the atmosphere interact with and cause the electromagnetic radiation to be redirected from its original path. How much scattering takes place depends on several factors including the wavelength of the radiation, the abundance of particles or gases, and the distance the radiation travels through the atmosphere. There are three (3) types of scattering which take place.

18. What is non selective scattering?

The Non-selective scatting is independent of wavelength. It is produced by particles whose Radii exceed 10mm such as water droplet. Non-selective scattering decrease the contrast of the imager

19. What are the various types of scattering?

(i) Rayleigh scattering occurs when particles are very small compared to the wavelength of the radiation.

(ii) Mie scattering

It occurs when the particles are just about the same size as the wavelength of the radiation.

(iii) Non Selective Scattering

The final scattering mechanism of importance is called nonselective scattering. This occurs when the particles are much larger than the wavelength of the radiation.

20. What is Atmospheric Windows?

These are certain regions of the electromagnetic spectrum which can penetrate through the atmosphere without any significant loss of radiation. Such regions are called as atmospheric windows. In these regions the atmospheric absorption is low, i.e the atmosphere is particularly transmissive of energy. The region which are referred as atmospheric windows include a window in the visible and reflected infrared region between 04 to 2.0 um where the remote sensors as well as the human eye operate and three windows in the thermal infrared region namely two narrow windows 3 and 5 um and third relatively broad windows extending from 8 to 14 um.

21. What is active and passive remote sensing system?

Passive sensors can only be used to detect energy when the naturally occurring energy is available. For all reflected energy, this can only take place during the time when the sun is illuminating the Earth. There is no reflected energy available from the sun at night. Energy that is naturally emitted (such as thermal infrared) can be detected day or night, as long as the amount of energy is large enough to be recorded.

On the other hand, provide their own energy source for illumination. The sensor emits radiation which is directed toward the target to be investigated. The radiation reflected from that target is detected and measured by the sensor.

22. What are the advantages of remotely sensed data?

Satellite images are permanent records, providing useful information in various wavebands. Large area coverage enables regional surveys on a variety of themes and identification of large features. Respective coverage allows monitoring of dynamic themes like water and agriculture, etc. Easy data acquisition at different scales and resolutions A single remotely sensed image cab be analyzed and interpreted for different purposes and applications Stereo satellite data M/J be used for three dimensional studies

23. What are the different platforms used in remote sensing?

The vehicle or carrier for remote sensor is borne is called the Platform." The typical platforms are satellite and aircraft, but they can also include radio controlled airplanes, balloons, pigeons, and kites for low altitude remote sensing, as well as ladder and cherry pickers for ground investigation.

24. Write the disadvantages of remotely sensed data?

- Expensive for small areas, particularly for onetime analysis
- Requires specialized training for analysis of images
- Large scale engineering maps cannot be prepared from satellite data.
- Aerial photographs are costlier if repetitive photographs are required to study for d ynamic features.

25. What is the interaction that takes place on earth surface?

When the electromagnetic radiation is incident on the earth"s surface, the basic interaction with the features takes place

$$E_I(\lambda) = E_R(\lambda) + E_A(\lambda) + E_T(\lambda)$$

The proportion of energy that are absorbed, radiated and transmitted vary depending on the type of materials with which the energy interacts and also depending on the wavelength of the energy. These proportions of energy that are absorbed, transmitted and radiated are unique to each and every earth features and this unique spectral reflectance property is explained as the spectral signature of the earth.

26. What is reflectance?

Reflectance is defined as the ratio of incident flux on the surface to the reflected flux from the surface. Reflectance with respect to the wavelength is called spectral reflectance. Spectral reflectance is assumed to be unique for each and every object.

$$\rho\lambda = E_R(\lambda) / E_I(\lambda)$$

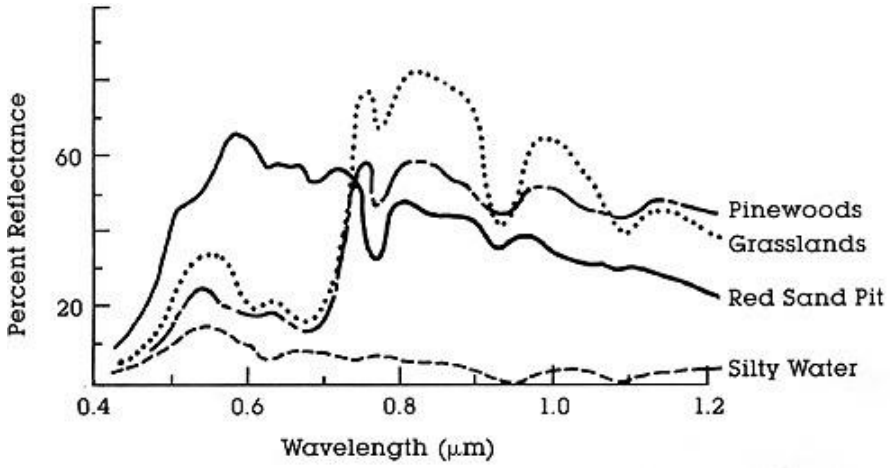
$\rho\lambda$ = is the spectral reflectance expressed in %

$E_R(\lambda)$ = Energy of the wavelength λ reflected from the object

$E_I(\lambda)$ = Energy of the wavelength λ reflected on the object

27. Define short notes on spectral signature.

Spectral signature is a set of characteristics by which n object on any satellite imagery within the given range of wavelength can be identified. Spectral signature are also used to donate the spectral response of the target, It refers to the sensing and recording power of the sensor in different bands of EMR. Spectral reflectance curves are called as spectral signature curves. These are the curves in which the variation of percentage reflectance with reference to the wavelength in the X-axis is plotted.



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28. List and explain the general process involved in electromagnetic remote sensing.

Two main processes involved in passive or electromagnetic remote sensing are

1. Data acquisition

   The data acquisition processes comprises distinctive elements namely

   Energy sources

   Propagation of energy through the atmosphere

   Energy interaction with the earth surface features

   Airborne, space borne, sensors to record the reflected energy

   Generation of sensors data as pictorial or digital information

2. Data analysis

   Data analysis can be broadly classified as

   Visual image interpretation

   Visual interpretation is the act or process of examining images (satellite imageries) for the purpose of identifying objects and assessing their significance. Visual image interpretation involves detection, recognition, identification, classification and delineation of objects in an aerial or a satellite image

   Digital image interpretation

   When computers are used to analyze digital data with various instruments then the process is called digital interpretation

29. Differentiate between air borne & space borne platform

Air borne plat forms

Balloons and aircrafts are broadly grouped under air borne platforms

Balloons - The use of balloons is commonly restricted by meteorological factors such as wind velocity , direction etc. Their application is resource mapping has been significantly ueful

Aircraft - they are used to obtain aerial photographs. They are useful in regional coverage and large scale mapping

Space - borne platforms

These are satellites which have proved to be very useful in resource mapping. Meteorological and communication applications.

30. Define the terms synoptivity.

When we get images, as seen from above the earth, the image patterns with in landscapes, seascapes and icescapes stand out distinctively. This characteristic of satellite data is known as synoptivity.

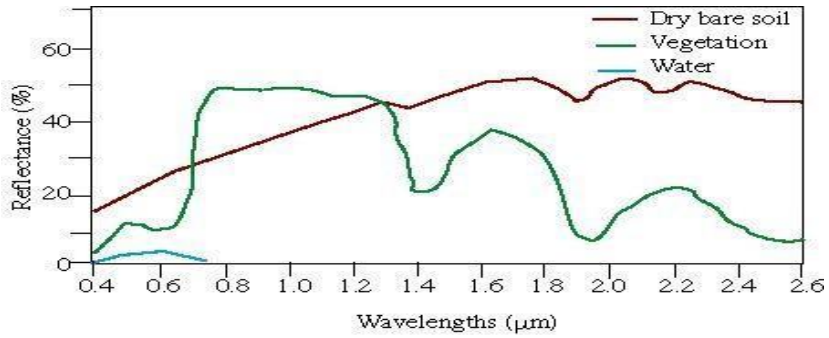
31. What is the signature of atmospheric windows?

These are certain regions of the electromagnetic spectrum which can penetrate through the atmosphere without any significant loss of radiation. Such regions are called as atmospheric windows. In these regions the atmospheric absorption is low, i.e the atmosphere is particularly transmissive of energy. The region which are referred as atmospheric windows include a window in the visible and reflected infrared region between 04 to 2.0 um where the remote sensors as well as the human eye operate and three windows in the thermal infrared region namely two narrow windows 3 and 5 um and third relatively broad windows extending from 8 to 14 um.

32. What is an atmospheric window?

The areas of the spectrum which are not severely influenced by atmospheric absorption and thus, are useful to remote sensors, are called atmospheric windows.

33. How does Electromagnetic radiation interact with water?



Typical spectral reflectance curves for vegetation, soil, and water.

Most of the energy is either absorbed or transmitted

VISIBLE RANGE

• Little energy is reflected only in this range

• Water quality studies

• Shallow Vs Deep water

• Clear Vs Turbid water

• Rough Vs Smooth

NIR RANGE (0.7 to 1.3 μm)

• Completely absorbs • Useful for delineating water bodies

• Algal bloom and/ or Phytoplankton results in reflection

34. What are the characteristic of EMR interaction with soil particles?

The factors that affect the reflectance of the soil are:

(i) Moisture content

(ii) Soil texture

(ii) Surface roughness and

(iv) Presence of organic matter

Moisture content: Increase in the amount of moisture content will decrease the reflectance this is greatly observed in the 1.4,1.9 and 2.7 μm bands.

Soil texture: Well drained soil has less moisture content and therefore high reflectance. Poorly drained, finely grained have more moisture content and therefore less reflectance. But under dry conditions there will be a reverse effect where the coarse textured soil will absorb more energy, reflectance will be less they will appear darker, while it will be the vice versa in the case of fine textured soil at dry conditions.

Surface roughness: Increase in the presence of surface roughness will decrease soil reflectance.

Organic matter: Increased presence of organic matter will decrease soil reflectance.

Iron oxide: Increased presence of iron oxide will decrease the soil reflectance in the visible region.

35. How does EMR interact with Ozone?

Ozone is a trace gas in the atmosphere. It is confined to the stratosphere (20-40 Km from the earth). Its maximum concentration is at 23 Km where the ozone dominates the shortwave radiation. The chappius band of the ozone in the visible region is the only band used to detect the ocean constituents from the space.

36. Explain the EMR interaction with water vapor.

Water Vapour is one of the preliminary absorbers of electromagnetic energy. The transmission of Chlorophyll fluorescence to the top of the atmosphere is hindered through the absorption by water vapour and molecular oxygen in their vibration action bands. In order to study the selective gaseous absorption in the radiative transfer calculations, the transmission functions of O2 and H20 are computer from absorption line parameters explained by Lorenz"s theory of collision broadening.

37. What are the atmospheric conditions affect the remote sensing?

The atmospheric conditions affect the remote sensing in two ways:

(a) The information reflected or radiated by the earth's surface can be modified while traversing the atmosphere.

(b) The absorption, reflection and scattering can be used for temperature and pressure profiles, cloud heights, particulate and gas analysis.

38. List out the different types of scattering.

Rayleigh scattering occurs when particles are very small compared to the wavelength of the radiation.

Mie scatteringIt occurs when the particles are just about the same size as the wavelength of theradiation.

Raman"s scattering is caused by atmospheric particles, which are larger, smaller of equal to that of the wavelength of the radiations being sensed.

Non Selective scattering The final scattering mechanism of importance is called nonselective scattering. This occurs when the particles are much larger than the wavelength of the radiation.

39. Explain Rayleigh & Mie Scattering.

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40. Differentiate between Raman s scatterings with others.

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42. What is the primary absorption of electromagnetic energy in the atmosphere.

Atmospheric constituents like water vapour, carbon dioxide, and ozone are the primary absorbers of energy.

43. Write the effects of atmosphere on spectral reflectance?

The atmosphere influence the radiance recorded by the sensor in the following ways.

(a) It reduces the energy illuminating the ground object.

(b) The atmosphere acts as a reflector supplementing the path radiance to the signal sensed by the sensor.