SNS COLLEGE OF TECHNOLOGY

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19AGT302 - GIS AND REMOTE SENSING

PART A (2 MARKS)

1. What is Remote Sensing? (M/J- 14)

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? (M/J- 13)

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, Co2 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.

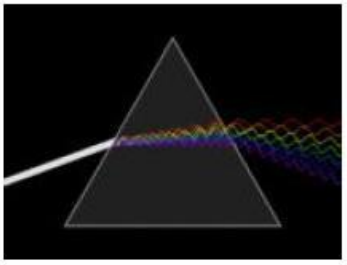
8. Draw the quantum theory interaction. **(M/J- 13)**

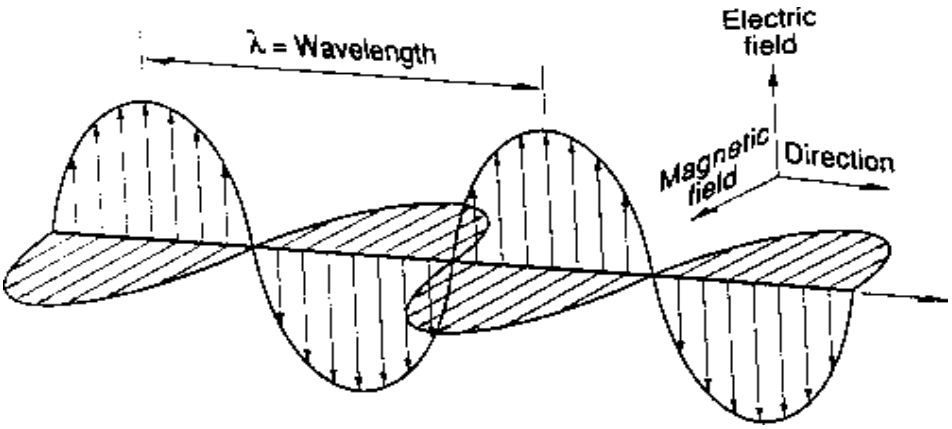
A quantum theory of the interaction between electromagnetic radiation and matter such as electrons is described by the theory of quantum electrodynamics.

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? **(M/J- 11)**

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. (N/D- 14)

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. (N/D- 14)

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? (N/D- 13)

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 forlow 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 analysisRequires
- 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? (N/D- 12)

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 featuresand 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.

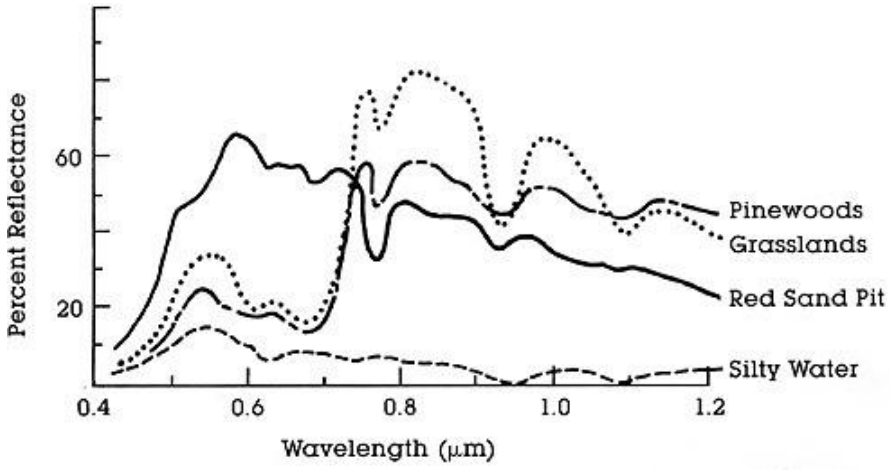
$$\rho\lambda = E_R(\lambda) / E_I(\lambda)$$

$\rho\lambda$ = is the spectral reflectance expressed in %
$E_R(\lambda)$ = Energy of the wavelength λ reflected from the object

E_I (λ) = 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 electromaggnectic remote sensing are

29. 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 energyGeneration of
sensors data as pictorial or digital information

30. 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

31. 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.

32. 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.

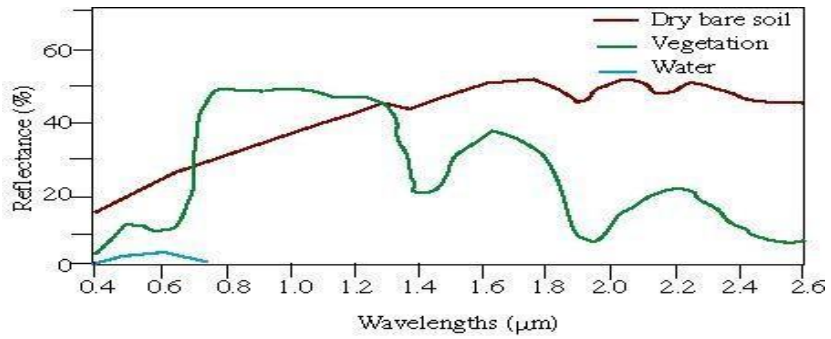
33. What is the signature of atmospheric windows?

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.

34. What is an atmospheric window? (N/D- 14)

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

35. How does Electromagnetic radiation interact with water?



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

Most of the energy is either absorbed or transmittedVISIBLE

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

36. 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 willbe a reverse effect where the coarse textured soil will absorb more energy, reflectance will be less they willappear 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.

37. 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.

38. 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.

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

The atmospheric conditions affet the remote sensing in two ways:

(a) The information reflected or radiated by the earth 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.

40. 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.

41. Explain Rayleigh & Mie 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.

42. Differentiate between Raman s scatterings with others.

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43. What is non selective scattering?

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44. What is the primary absorbs of electromagnetic energy in the atmosphere.

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

45. 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.

44. What are the sensors used in IRS?

The data for all the sensors of IRS -1C/1D are supplied on digital media like

a) Computer copatible tapes (CCTs)

b) Cartridge tapes

c) Floppies

d) CD-ROM products

45. What is false color compositor?

It is one of themost widely used data format for information extraction and it is called as false color compoite image (FCC). False colour composites are nothing but the reflectance characteristics of the surface features in different bands. The reflectance characteristics of the same features in different bands are assigned different colours, thus giving composite image called false colour composites

46. Explain about dia positives.

Dia positives are the silver halide prints of the earth features. Aerial photographs are the actual dia positives, they M/J be either black and whit or colour in nature.

47. Explain about microwave sensor.

Electromagnetic radiation at along wavelength (0.1 to 30 Cm) falls in to a segment of the spectrum commonly called the microwave region. At still longer wavelengths the radiations are known as radio wave.

48. What is a satellite?

Satellites are devices that use sensor to observe the earth and our solar systems. Satellites are also used to observe the earth‟s atmosphere, surface and oceans.

49. How satellites are classified?

1. Spy satellite, 2. Weather satellite 3. Communication satellite
3. Earth resource satellite

Based on orbit

1. Geostationry satellite, 2. Polar orbiting satellite
2. Inclined orbit satellites 4. Molniya orbit satellites

50. What is sun synchronous satellite?

Sun synchronous satellites are located at much lower altitudes, generally a few hundred to a few thousand kilometre from the earth surface. The orbit in which they rotate is a special case of polar orbits, these satellites travels from north to south pole as the earth turns below it. These satellites pass once the same part of the earth roughly the same local time each day making communication and collection of various forms of dat. Most of the earth resource satellites are sun synchronous satellites.

51. What are geo synchronous satellites?

These satellites orbit at an elevation of approximately 35790 km because that produces an orbital period equal to the periods of rotation of the earth. The satellite appears stationary as it is orbiting at the same rate in the same direction of the earth. These satellites provide a bigger view of the earth, thus facilitating coverage of weather events. These satellites as they are in the equatorial plane.

52. What are polar orbiting satellites?

Polar sun synchronous orbitLow
altitude (200-1000km) Goes
close to poles
Higher spatial resolution than geostationary Lower
temporal resolution than geostationary

53. What is MSS?

Multi-Spectral Scanner (MSS) which acquires imagery in fourspectral bands: blue, green, red and near infrared. The second is the Thematic Mapper (TM) which collects seven bands: blue, green, red, near- infrared, two mid-infrared and one thermal infrared. The MSS has a spatial resolution of 80 meters, whilethat of the TM is 30 meters.

54. Write short notes on Different types of platform used in remote sensing.

Two types of plat forms have been used in remote sensing

1. Airborne plat forms
2. Space based plat forms

55. Explain Multi spectral sensing system

MSS is an acronym for multispectral scanner. It is an across track scanning system, a sensor used in the Landsats. The scanning mirror oscillates through an angle of +5.78° to -5.78° of nadir. It has a 11.56degree field of view (FOV) and a swatch width of 1.85 km, a parallel scanner sensitive to four spectral bands which view ground simultaneously. The spatial resolution is 68 M across track and 83 M along track. The typical scene contains about 2340 scan lines with about 3240 pixels per line. The collection of MSS data ceased in 1992, when the use of TM data in Landsat-4 started.

56. What are the different types of resolution used as parameters of sensors?

The resolution of a data set defined the smallest object of feature that is included or discernable in the data.

1. Spatial resolution
2. Spectral resolution

3. Radiometric resolution
4. Temporal Resolution.

57. List out the Metrologic satellite?

NOAA GOES
NIMBUS
METEOSAT
METHA-TROPIQUES

58. Explain about earth resources satellite

Earth resources satellites are usually sun synchronous or polar orbiting satellite used to study and access the earth‟s resources. Their aim is to provide multispectral image for better information regarding the earth‟s resources, environmental change and impacts of human activities. In Indian this work is done byIRS series. These satellite are also useful in monitoring of earth‟s resources, climatic and land use changes. The lansats of America and Spot of France, JERS of Japan are also other kind of ERS.

59. What are the elements of Resolution?

The four elements of resolutions are Spatial, Spectral, Radiometric and Temporal.

60. What are the various types of Resolution?

The four elements of resolutions are Spatial, Spectral, Radiometric and Temporal.

61. Short account on spatial Resolution.

It is the minimum elemental area the sensor can detect or measure. The resolution element is called pixel (picture element). Example: IRS LISS 1-72.5m; LISS II-36.25m Land sat MSS-80m; Land sat TM-30m SPOT MSS HRV-120m; SPOT MSS HRV II-10m

62. Explain the term spectral Resolution. (N/D- 12)

It refers to the sensing and recording power of the sensor in different bands of EMR. The sensors can observe an object separately in different bands or colors. Examples: IRS-4 bands; Land sat MSS-4 bands; Land sat MSS TM-7 bands SPOT-4 bands It is the ability if the sensor to distinguish the finer variation ofthe reflected radiation from different objects.

63. What is Radiometric Resolution?

It is the smallest amount of energy that can be detected by sensor and differentiate the same in a defined scale. It is recorded in digital number (DN) for different bands of the satellite. The radiometric value of the pixel is the average of the values coming from every part of the pixel. Example: IRS-128 gray level; Land sat MSS-64; Land sat TM-256; SPOT-256(it is to be noted that „0‟is also a value in the gray scale).

64. Write Short notes on Temporal Resolution.

It is the time interval between two successive surveys of a particular place of the earth by the sensor or satellite. Examples: IRS-22days; Land sat 16/18days; SPOT-16days.

65. What is microwave Sensor?

Microwaves are electromagnetic waves with wavelengths ranging from one meter to one millimetre with frequency between 300MHz and 300GHZ, Uses of Microwaves. 1. Satelite communication 2.Radar 3.Radioastronomy 4.Navigation 5.Spectroscopy.

66. Write the various types of microwave sensors.

Active microwave sensors are generally divided into two distinct categories: imaging and non-imaging.The most common form of imaging active microwave sensors is RADAR.

67. What is Radar? **(M/J- 12)**

RADAR is an acronym for RAdio Detection And Ranging, which essentially characterizes the function and operation of a radar sensor. The sensor transmits a microwave (radio) signal towards the target and detects the backscattered portion of the signal.

68. What is the main use of Radar?

RADAR is an acronym for RAdio Detection And Ranging, which essentially characterizes the function and operation of a radar sensor. The sensor transmits a microwave (radio) signal towards the target and detects the backscattered portion of the signal.

69. What is image interpretation? **(M/J- 14)**

Image interpretation is defined as the extraction of qualitative and quantitative information in the form of a map, about the shape, location, structure, function, quality, condition, relationship of and between objects, etc. by using human knowledge or experience.

70. Describe an image with its properties. **(N/D- 14)**

Image processing is a physical process used to convert an image signal in to a physical image. Image processing usually refers to digital image processing, but optical and analog image processing also are possible.

71. What is the type s image interpretation? **(M/J- 13)**

Image M/J be classified by adopting either of the following methods

1. Spectral pattern recognition
2. Spatial patter
3. Supervised classification
4. Unsupervised classification

72. What is visual image interpretation? **(M/J- 12)**

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.

73. What is photo interpretation?

Photo interpretation is defined as the process of identifying objects or conditions in aerial photographs and determining their meaning or significance.

74. What is image measurement?

Image measurement is the extraction of physical quantities, such as length, location, height, density, temperature and so on, by using reference data or calibration data deductively or inductively.

75. What is called photographical interpretation? **(M/J- 14)**

Interpretation and analysis based on aerial photographs using stereoscopic vision.

76. Differentiate supervised & unsupervised classification.

A supervised classification algorithm requires a training sample for each class i.e a collection of data points know to have come from the class of interest. The classification is based on how near a point to be classified is to the training data set. Unsupervised classification algorithms do no compare points to be

classified with training data. The unsupervised algorithms examine a large number of unknown data vectors and divide them into classes based on properties inherent to the data themselves. Thus the classes are separated from the differences observed within the data.

77. What is image analysis?

Image analysis is the understanding of the relationship between interpreted information and the actualstatus or phenomenon, and to evaluate the situation.

78. What is thematic map? (N/D- 14)

Extracted information will be finally represented in a map form called an interpretation map or a thematicmap.

79. What is Interpretation map?

Extracted information will be finally represented in a map form called an interpretation map or a thematicmap.

80. What are the image interpretation elements?

The eight elements of image interpretation are shape, size, tone, shadows, texture, site, pattern and association.