

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI (RAJ.)

BITS F442/CE F433
Date:

Remote Sensing and Image Processing
Mid Semester Examination

Duration:
MM:

Q.1 Select the appropriate alternatives: (1*15)

1. Which one of the following is a preliminary data processing task

a) **Classification** b) Interpretation c) Interpolation d) None

2. Interpolation provides the output in the following form

a) Vector b) **raster** c) both d) None

3. Classification of an image without specification of classes is called

a) Supervised b) **unsupervised** c) Selective d) Non-selective

4. Topology refers to the following for vector data

a) Editing b) **Correction** c) Analysis d) Presentation

5. A map for a terrain is

a) **Orthographic projection** b) perspective projection c) Oblique projection d) None

6. In the world of GIS, another term for the property of connectivity is:

a) Proximity b) neighborhood c) **topology** d) boolean identity

7. Line dropping refers to the following terms

a) Classification b) **reclassification** c) **Map dissolve** d) All of these

8. A proximal search to find regions of space nearest to each of a set of irregularly distributed sample points generates.

a) **Theissen polygons** b) **Voronoi diagrams** c) Triangulated Irregular network d) None of these

9. In standard FCC which wavelength is passed through blue gun:

a) red b) **green** c) blue d) Infra red

10. Which is a fundamental task in image processing used to match two or more pictures?

a) **registration** b) segmentation c) computer vision d) image differencing

11. Groups of adjacent cells with the same values in a raster are described as

a) Zone b) region c) area d) vicinity

12. Given a set of elevation sample points of a particular area, the technique that could be used to generate an elevation surface for the same area is:

a) Interpolation b) Projection c) Reclassification d) Overlay

13. Scanning at right angle to flight line is called

a) pushbroom scanning b) whiskbroom scanning c) across track scanning d) along track scanning

14. Along track scanners are better than cross track scanners in terms of:

a) dwell time b) signal to noise ratio c) radiometric resolution d) All of these

15. Linear features other than those parallel or normal to the scan lines take on an S-shaped sigmoid curvature due to

a) tangential scale distortion b) changing ground resolution distance c) high altitude d) All of these

Q.2 State whether the statements are true or false with reason: (1*15)

1. Skewed images are captured due to crab distortion of flight.
False, due to roll distortion
2. A graybody has an emissivity that is less than 1 but is constant at all wavelengths.
True, it keeps the same ratio of radiant energy at all wavelengths as compared to corresponding black body.
3. Thermal inertia is a measure of heat storage by a material.
False, it is a measure of the response of a material to temperature changes.
4. 1 mm to 1 cm is the microwave portion of the EM spectrum.
False, it is 1 mm to 1 m for microwave
5. Spatial search and analysis are preliminary data processing functions.
False, these functions are applied to structured data transformed from raw data
6. Containment search within a region use relational data base query language.
False, it requires the capacity to clip spatial objects consisting of linear and polygon components at the boundary of the spatial window.
7. Delaunay triangulation is the dual of a Voronoi diagram.
True
8. Raster data models are used to represent relatively precisely defined set of paths such as roads and rivers.
False, network data models are used to represent such paths.
9. Function like weighted average if local operation in grid cell based processing.
False, it is a focal operation
10. Radar is a passive microwave sensor.
False, it is an active sensor

11. PPI (Plan position Indicator) systems of Radar are not appropriate for most remote sensing applications.
True, because they have poor spatial resolution
12. The ground resolution cell size of an SLR system is controlled by flight direction and orientation.
False, it is controlled by pulse length and antenna beamwidth
13. The width of antenna beam in SLR system determines the spatial resolution in range direction.
False, it determines the spatial resolution in flight or azimuth direction.
14. Any time overlap between the signals in SLR from two objects will cause their images to be blurred.
True
15. Radiant temperature will increase with the increase in the kinetic temperature of a blackbody.
True, because $T_{rad} = \epsilon^{1/4} T_{kin}$

Q.3 Give the reasons/answer the following statements: (1*15+5)

1. Size of ground resolution cell increases symmetrically on each side of the nadir in across track scanning system.
Due to increase in distance between the scanner and the ground resolution cell as per equation: $D = H'\beta$ where D = diameter of ground resolution cell, H' = height of scanner and β = IFOV
2. A system with larger IFOV will have a higher signal to noise ratio than with one with a smaller IFOV
A large IFOV yields a signal that is much greater than the background electronic noise (extraneous, unwanted responses) associated with any given system.
3. Across track scanned images are rarely used as a tool for precision mapping
Across track scanners are subjected to altitude and attitude variations due to the continuous and dynamic nature of scanning, but also their images contain systematic geometric variations due to the geometry of the across track scanning.
4. What is tangential scale distortion?
When an across track scanner scans away from the nadir line perpendicular to the flight direction, the ground element covered per unit time increases with increasing distance from the nadir. This results in image scale compression at point away from nadir. The resulting distortion is called as tangential scale distortion.
5. What does it mean by relief displacement in an aerial photograph
While an aerial photograph is captured it generates the image of relief not along nadir line, away from its true orthographic position. Such a phenomenon is called as relief displacement.

6. In forest fire mapping systems operating in the 3 - 5 μm atmospheric windows are used instead of 6-14 μm range of thermal system.

when objects are heated above the ambient temperature, their emissive radiation peaks shift to shorter wavelengths.

7. Radar systems do not directly measure the reflectance of the surface.

They record the intensity of the radiation that is backscattered by the surface, i.e. the fraction of the incident energy that is reflected directly backwards towards the sensor.

8. Incidence angle in spaceborne radar imaging is slightly greater than look angle while it is approximately equal in airborne radar imaging.

In airborne system it is like a flat surface hence incidence angle is equal to look angle while in space borne systems incidence angle is slightly greater than look angle due to earth curvature.

9. Derive an expression for obtaining the correct position of an object on ground from an unrectified thermogram.

On unrectified imagery, y coordinate will relate directly to angular dimensions, not to linear dimensions. In order to determine the ground position Y corresponding to image position p, we must first compute Θ from the relationship:

$$y/y_{\text{max}} = \Theta/\Theta_{\text{max}}$$

$$\text{rearranging } \Theta = y \Theta_{\text{max}}/y_{\text{max}};$$

where y= the distance measured on the image from the nadir line to point p

y max= the distance from the nadir line to the edge of the image

Θ_{max} = one half of the total field of view of the scanner

Once Θ has been computed , it may be trigonometrically related to the ground distance Y by

$$Y = H \tan \Theta$$

10. Two buildings A and B are recorded as a single object in SLR system.

Since the slant range distance between buildings A and B must be lower than half of the pulse length.

11. Blue band is not present in the latest satellite missions of IRS series.

Because blue band scatters the light most.

12. A building has high signal strength in SLAR than a water body, although moisture content provides high signal strength.

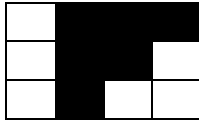
SLAR detect the objects from their return signals. Buildings due to their height blocks and return the signals while water bodies reflect the signal in other directions equal to their incidence angle.

13. Contours can be generated by using interpolation.

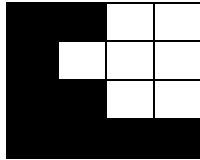
Interpolation provides the method to estimate the values of an unknown region based upon the values of the regions surrounding it. Hence contours can be generated by interpolation.

14. Find the intersection and union of:

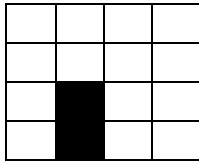




S



T



S intersection T



S Union T

15. A given SLAR system has a 2.0 mrad antenna beamwidth. Determine the azimuth resolution of the system at slant range of 8 and 10 km.

$$Ra = SR \cdot \beta ; \text{ therefore for 8 km} = 16 \text{ m and for 10 km} = 20 \text{ m}$$

16. Match the following:

a. IDW	Orthographic	b
b. Map	Image registration	d
c. Georeferencing	Interpolation	a
d. Rectification	TIN	e
e. DEM	Ground Control Points	c

Q 4. Fill in the blanks: (15*1)

a) Utilising different types of electronic detectors, multispectral scanners can extend the range of scanning from 0.3 μm to approximately 14 μm .

b) A dichroic grating is used to separate thermal and non thermal wavelengths.

c) The sampling rate for a particular signal is determined by the highest frequency of change in signal.

d) Two pixels on the same object might be adequate to determine the objects orientation in an image.

e) Stronger signal to noise ratio leads to better radiometric resolution.

f) Roll, crab and pitch are kinds of flight distortions in an image.

g) Blackbody radiations are a function of the material involved and the temperature of the object.

h) The relationship between the wavelength of peak spectral exitance and temperature of a blackbody is given by Wien's displacement law.

- i) Total radiant exitance from the surface of a blackbody varies as the **fourth** power of absolute temperature.
- j) The emitting ability of a real material, compared to that of a blackbody, is referred to as a material's **emissivity**.
- k) Water behaves as a **blackbody** radiator while quartz behaves as a **selective** radiator for wavelengths in the 6-14 μm range.
- l) The rate at which heat passes through the material is called **thermal conductivity**.
- m) The ground resolution cell size of a SLAR system is controlled by **pulse length** and **antenna beamwidth**.
- n) Proper distribution of the points selected is required for **georeferencing** an image.
- o) The points which indicates no radiant temperature difference between two materials are called **thermal crossovers**.