

SECTION I

1. Remote Sensing and GIS are integral to each other.
What does Remote Sensing and GIS mean?

Answer: Remote Sensing means obtaining information about an object, area or phenomenon without coming in direct contact with it. While GIS is the Information System that is used to input, store, retrieve, manipulate, analyze, and output.
@ 4 marks

2. Data by itself is generally different from information.
What is the main difference between the two.

Answer # Information is interpreted data. Information is data placed with a meaningful context.

Data are raw that describe person, places, thing or events that have occurred or are about to take place. @ 4 marks

3. There are two maps of an area.

- Map A, on which 1 cm represents 2.5 km in reality.
- Map B, on which 1 cm represents 500 m in reality.

a) What is the scale of map A?

b) Which of the two maps has the larger scale, map A or map B?

Answer: # Scale of map A is 1:250,000 @ 3 marks
Larger scale map is map B @ 2 marks

4. What is the meaning of the elements in the following formula

$$E = hc/\lambda$$

Answer: E = Energy of a photon / 1
h = Planck's constant. / 1
 λ (Lambda) = Wavelength / 1
c = Speed of light. / 1

@ 4 marks

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⑤ List (3) three classes of map projection based on the type of surface used.

Answer # Cylindrical / 1 mark
Conical / 1 mark
Azimuthal / 1 mark

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⑥. What do you understand by spatial data?

Answer : Spatial data is "Where the object is" or is a feature that has a known location on Earth. 2 marks

7. Among the following examples of datasets, which one is spatial or non-spatial data?

Location of boreholes → Spatial / 1 mark
Number of population in given district → Non spatial / 1 mark
Time interval between two countries → Non Spatial / 1 mark
Road Network in Kigali city → Spatial / 1 mark
@ 4 marks

⑧ Real world data can be represented as either Vector or Raster data. What are the main differences between two.

Answer : Vector data uses discrete point, lines / or Areas corresponding to discrete objects with a name or code of number of attributes. 1.5 marks

Raster data uses regularly spaced equal sized grid cells in specific sequences. 1.5 marks

@ 3 marks.

⑨ Propagation of Electromagnetic energy can be modeled by : (sine or cosine waves, an electric or a magnetic field, the constant of planck, photons and waves, Stefan - Boltzmann's law) Set 1 one answer.

Answer : Propagation of Electromagnetic Energy can be modeled by "photons and waves". 2 marks

- 18) What is the name of the process that produces:
- a) Digital vector data from paper maps?
 - b) Digital raster data from paper maps?

Answer: A) The Name of the process that produces digital vector data from paper maps known as "Digitizing" 3 marks

b) The Name of the process that produces digital raster data from paper maps is Scanning. @ 3 marks

- 19) Distinguish the right and wrong among the following statements.

All geographic phenomena have boundaries → Wrong 1

Kigali city image is a vector data → Wrong 1

Houses can be represented as lines in GIS representation → Wrong 1

With Additive coloring, red and green results in yellow → Right 1

The wavelength of the EM energy by a black body is independent of its temperature. → Wrong 1 mark

- 20) List four (4) Image characteristics of the sensor platform system, which you take into account when selecting image data.

Spatial characteristics

Spectral characteristics

Radiometric

characteristic

Temporal

Pixel size

Number of bands

Revisit time

A only point 4 each.

- 21) I want to observe the amount of light emitted by cities during the night. Which type of sensor would be suitable?

Answer: Thermal Scanner 2 mark

Q14 What do you understand by the term platform as Applied in Remote Sensing?

Answer : platform is a moving vehicle that often carries a sensor. @ 1/2 marks

Q15 List two (2) Examples of platform you know:

- Answer :
- # Satellite
 - # Air craft
 - # Space station
 - # Space shuttles 2 marks

Q16 Note, there can be none, one or several correct answers in the list:

Answer : # Conversion from one data format to another can cause data loss because not all formats capture the same information. 3 marks

SECTION II

Q17 Raster representation	Vector representation
* Advantages:	
# Simple data structure - easy to process	# Can make use of Topology
# Efficient for image processing.	# Adapts well to scale changes # Allows representing networks # Allows easy associated with attribute data??
* Disadvantages:	
# Cell boundaries independent of feature boundaries	Complex data structure
# Difficult in representing topology # Less compact.	# overlay more difficult to implement # Inefficient for image processing # More update - intensive

@ 10 marks.

18) Definitions of a geographic information system can vary considerably. The definitions combines both the components and functions of a GIS. Discuss those components needed to perform GIS tasks?

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Answers # people: this is most important component of GIS. people must develop the procedures and define the tasks of the GIS. @ 2.5 marks

Data: the availability and accuracy of data can affect the result of any query or analysis @ 2.5 marks

Hardware: Hardware capabilities affect processing speed, ease of use, and the type of output available. @ 2.5 marks

Software: this includes not only actual GIS software but also various databases, drawings, statistics, etc. @ 2.5 marks

Procedures: Analysis requires well-defined, consistent methods to produce accurate, reproducible results. @ 2.5 marks

19)

- a) List at least three (3) sources of data for GIS
b) By giving example, distinguish these two types of data: Spatial and vector data.

Answer: A) Diverse source of a GIS data are:

Aerial photographs 1 mark

Satellite Imageries 1 mark

Digital data 1 mark

Census

Meteorological department

field data (surveys, GPS).

@ 3 marks.

B) # Spatial data tells us "where the object is", or it has a known location on earth 2.5 marks

Attribute data tells us "what is the object", or how much the objects or it tells the characteristics of the objects 2.5 marks

Eg of spatial Data: Road Network, location of Building 1 mark
Eg of Attribute Data: length of Road, Road type, height of building 1 mark

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Q20 a) Suppose that you are designing an optical multispectral passive sensor for a spaceborne satellite. What are the two most important criteria that should be considered for choosing the wavelengths of the bands?

b) Geographic objects in vector data can be abstracted into three geometric shapes. List these shapes and provide two examples for each shape.

Answer: a) # the wavelength should belong to "atmospheric windows"
eg: it should not be strongly absorbed by the atmosphere 2 marks

land-cover classes: eg: It must correspond for specific features of spectral reflectance curves for given classes. 1 mark

b) line: Road Network, drainage channels etc 1 mark
point: boreholes, police station etc 2 marks
polygon: parcels, building etc 2 marks

Q21 by help of diagram demonstrate and discuss the principal difference between active and passive sensor. Give two examples of each type of sensor.

Answer # passive sensor depend on an external source of energy, usually the sun. 1.5 mark
eg: Sun and Earth / Atmosphere 1 mark / 2.5 mark

Active sensor have their own source of energy. Emits radiations that is reflected back partly to the sensor source of energy. 1.5 mark / 2.5 marks
eg: Radar, LIDAR 1 mark

Passive Sensors

- # Source of Radiation is External
- # Solar Reflect radiation
- # Earth Thermal emission



@ 2.5 marks

Active Sensors

- # Emits radiation that is partly reflected back to the sensor
- # Radar
- # LiDAR



2.5 marks

SECTION II

Q2) How data obtained from Aerial photo interpretation can be used in GIS? What is detection cost is used data correction.

Answer: # Topographic mapping: These basis of topographical mapping using Aerial photograph is the common overlap between two successive photos in the forward and lateral direction.

@ 1.5 marks

Geology: It involves both surface and sub-surface mapping for mineral and other geophysical exploration.

@ 1.5 marks

Soil mapping: It is well known that the soil are derived from rock and the soil are in general, surface features.

1.5 marks @

Forestry: the main application of photo interpretation to forestry involves:

- (i) base map preparation
- (ii) identification of trees species
- (iii) quantitative measurements.

@ 1.5 marks.

Terrain Evaluation: The study of terrain is essential and prerequisite for a proper planning and utilization of land source. 1.5 marks.

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Land use land cover: The term land use refers to the human activity associated with the specific piece of land whereas the term land cover related to the type of feature present on the surface of earth. 1.5 marks @

Agricultural: The three major areas in which photo interpretation can help in the discipline of Agriculture are:

- (i) Crop Condition
- (ii) Crop type Classification
- (iii) Crop yield estimation @ 1.5 marks

Water resources: The application of aerial photo interpretation techniques of water resources involves two types (i) Mapping surface water bodies (ii) Surface or ground water potential. @ 1.5 marks

Environmental studies / flood drainage studies: It includes
* Water pollution
* Deforestation
* Industrial pollution. @ 1.5 marks

Q) What is detection?

Detection: is the process of picking out an object or element from photo or image through interpretation techniques. It may be detection of a point or line or a location, such as, Agricultural field and a small settlement.

@ 1.5 marks.

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Q3) a) Discuss on the input required before using a GPS receiver

b) List and Explain the type of hierarchical Referencing System in use today.

Answer : A) Input required before using a GPS Receiver:

Position format units (Example: UTM 11T 0557442m E4836681MM) this input determines the way positions are displayed on the Receiver Screen. For Example, sometimes you may want to use latitude/Longitude Coordinates and other times it may be better to use UTM Coordinates. *1.5 marks*

Map datum (Example: WGS 84, NAD 27 and NAD 83). This input ensures that your GPS Receiver and map are both using the same datum, which is extremely important for accuracy. *1.5 @ mark*

Distance units (feet, miles, and meters) *1.5 marks*

Elevation units (feet or meters) *@ 1.5 marks*

North Reference (True, magnetic, or grid) *1.5 marks*

Time format (12 or 24 hours) and time zone. *1.5 marks*

b) Types of hierarchical Referencing System in use today: *@ 9 marks*

Land Administration and title system: *1.5 marks*

Municipal Address: *1.5 marks*

Postal Enumeration *1.5 marks*

Census Enumeration Areas *1.5 marks*

Q4) Mark with X the correct phenomena and indicate a suitable Computer (GIS) representation is by choosing from the list below.

- X TIN
- X Line
- X Raster
- X Point
- X Area

Phenomena	Field	object	choose a suitable Computer GIS
Air quality	X <i>1.5 mark</i>		Raster or Tin <i>3 marks</i>
Post office		X <i>1.5 mark</i>	Point <i>2 marks</i>
Lake		X <i>1.5 mark</i>	Polygon <i>2 marks</i>
Read network		X <i>1.5 mark</i>	Line <i>2 marks</i>

@ 15 marks