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Q.1.

Useful Bands for Different Studies with Landsat-8 and Sentinel-2 Data:

(a) Vegetation: Near-infrared (NIR) bands are particularly useful for vegetation studies as they are sensitive to chlorophyll content. Bands such as NIR and Red-edge are commonly utilized.

(b) Urban Area: For urban areas, bands like Red and Shortwave Infrared (SWIR) can be beneficial. These bands help in detecting impervious surfaces and urban features.

(c) Water Area: Bands in the blue and green spectrum are essential for water body detection. Additionally, the Near-infrared (NIR) band can also be useful, especially for detecting shallow water bodies.

Q.2.

Procedure for Extracting Region of Interest (ROI) and Sample Size:

The procedure typically involves selecting training samples within the ROI representing each land cover class. The number of samples per cover depends on factors like the complexity of the landscape and the desired accuracy. Generally, a sufficient number of samples should be taken to adequately represent the variability within each land cover class. A common approach is to aim for a minimum of 30 samples per class, although more may be needed for complex landscapes.

Q.3.

Pure Pixel vs. Mixed Pixel and Extraction of Information:

A pure pixel represents a single land cover type, while a mixed pixel contains contributions from multiple land cover types within its spatial footprint.

To extract information from a mixed pixel, spectral unmixing techniques can be employed. These techniques aim to estimate the abundance fractions of different land cover types within each mixed pixel. Linear spectral unmixing is a common approach where spectral signatures of endmembers (pure pixels) are used to estimate their fractions within mixed pixels.

Q.4.

Difference between DEM and DTM and DEM Creation Method:

DEM (Digital Elevation Model) represents the bare ground surface elevation, while DTM (Digital Terrain Model) includes both natural terrain features and built structures.

To create a DEM for a given location, data from various sources such as LiDAR, stereo photogrammetry, or satellite imagery can be used. These data are processed to generate a raster grid where each cell contains elevation values representing the terrain surface.

Q.5.

Minimizing Errors in GIS Data Collection and Propagation of Errors:

Errors in GIS data collection can be minimized through careful field data collection, using high-quality reference data, employing accurate measurement techniques, and validating collected data through quality assurance processes.

Errors can propagate further in GIS through processes like data integration, analysis, and modeling. Each step introduces its own sources of error, and if not properly managed, these errors can accumulate and propagate through subsequent analyses.

While it's challenging to achieve completely error-free data collection in GIS, thorough quality control measures and continuous improvement efforts can help minimize errors to an acceptable level.

!.6.

Utility of Metadata in GIS and Metadata Collection Procedure:

Metadata provides essential information about GIS datasets, including their source, quality, accuracy, and content. It helps users understand and evaluate the reliability and suitability of the data for their specific applications.

Metadata can be collected during the data acquisition process by documenting relevant information such as data collection methods, sensor specifications, coordinate systems, accuracy assessments, and any processing steps applied to the data.

Q.7.

Elements of Visual Inspection for Remote Sensing Images:

Visual inspection involves assessing various elements such as:

Image clarity and sharpness

Color balance and contrast

Presence of artifacts or distortions

Identification of features and land cover types

For the Prayagraj region, visual inspection may involve identifying land cover types such as urban areas, water bodies (e.g., the Ganges River), vegetation, and built-up areas like roads and infrastructure.

Q.8.

Definition of TP and FN for a Multiclass Classifier and Confusion Matrix Example:

In a multiclass classifier:

True Positive (TP): Instances correctly classified as belonging to a particular class.

False Negative (FN): Instances incorrectly classified as not belonging to a particular class when they do.

Example Confusion Matrix:

	Class 1 (Actual)	Class 2 (Actual)	Class 3 (Actual)	Class 4 (Actual)
Class 1 (Predicted)	TP	FN	FN	FN
Class 2 (Predicted)	FP	TP	FN	FN
Class 3 (Predicted)	FN	FP	TP	FN
Class 4 (Predicted)	FN	FN	FP	TP

In this confusion matrix, TP represents correctly classified instances for each class, while FN represents instances incorrectly classified as belonging to other classes.