**Question 1**

**(a) What is GIS and what are the main components and functions of GIS?**

1. **Definition of GIS**:
   * A Geographic Information System (GIS) is a computer-based system that captures, stores, analyzes, and visualizes geographic (spatial) data.
   * It integrates hardware, software, and data to manage and analyze spatial information.
2. **Main Components of GIS**:
   * **Hardware**: Computers, servers, and GPS devices used for data processing.
   * **Software**: GIS applications like ArcGIS, QGIS.
   * **Data**: Spatial (maps, satellite imagery) and non-spatial (tabular data).
   * **People**: Users and analysts interpreting the data.
   * **Methods**: Processes and workflows for spatial analysis.
3. **Functions of GIS**:
   * Data capture and storage.
   * Data manipulation and editing.
   * Spatial analysis (e.g., buffer zones, overlays).
   * Visualization through maps and 3D models.
   * Decision support for urban planning, environmental management, etc.

**(b) Difference Between Vector Data and Raster Data**

1. **Vector Data**:
   * Represents data using points, lines, and polygons.
   * Examples: Roads (lines), buildings (polygons), trees (points).
   * Advantages: High precision, smaller file size for discrete features.
   * Disadvantages: Complex data structure, unsuitable for continuous data.
2. **Raster Data**:
   * Represents data as a grid of cells or pixels, where each cell has a value.
   * Examples: Elevation maps, satellite imagery, temperature data.
   * Advantages: Suitable for continuous data, easy to process.
   * Disadvantages: Larger file size, lower precision for discrete features.

**(c) Examples of Spatial and Non-Spatial Data**

1. **Spatial Data**:
   * GPS coordinates, satellite images, land use maps, road networks.
2. **Non-Spatial Data**:
   * Population statistics, property ownership records, traffic volume.

**Question 2**

**(a) 4 main ideas of Geographic Information Systems**

1. Create geographic data.
2. Manage it in a database.
3. Analyze and find patterns.
4. Display it on a map.

**(b) When to Use Raster and Vector Features**

1. **Raster**:
   * Use for continuous data like elevation, temperature, or rainfall.
   * Example: Climate studies, vegetation analysis.
2. **Vector**:
   * Use for discrete features like boundaries, infrastructure, or property lines.
   * Example: Urban planning, transportation networks.

**(c) Tablet Digitizing and On-Screen Digitizing**

1. **Tablet Digitizing**:
   * Process of tracing paper maps on a digitizing tablet to convert them into digital data.
   * Advantages: Useful for large-scale hardcopy maps.
   * Disadvantages: Time-consuming and less common now.
2. **On-Screen Digitizing**:
   * Process of tracing features from scanned images or maps displayed on a computer screen.
   * Advantages: Faster, more precise, commonly used with GIS software.
   * Disadvantages: Requires high-quality base maps.

**Question 3**

**(a) Types of Primary and Secondary Data Sources for GIS**

1. **Primary Data Sources**:

* Remote-sensing.
  + Digital satellite images.
  + Digital aerial photographs.
* GPS measurements.
* Survey measurements

1. **Secondary Data Sources**:

* Maps.
* Tabular data
* Textual data
* Digital products

**(b) Available Geo-Portals and Data Acquisition**

There are three basic types of spatial portal:

1. Catalogue portals
2. Application portals.
3. Enterprise portals.

**Examples of Geo-Portals**:

* + USGS Earth Explorer
  + OpenStreetMap
  + Copernicus Open Access Hub
  + NASA EarthData

**Process to Obtain Data**:

* + Register or log in to the portal.
  + Search for data by location, time, or type.
  + Download the data after specifying the desired format.

**(c) Steps to Ensure Efficient and Accurate Digitization**

1. Use high-quality base maps or imagery.
2. Ensure proper georeferencing of the base map.
3. Use appropriate scale for digitizing.
4. Minimize manual errors through software tools.
5. Validate data with ground truthing or additional sources.

**Question 4**

**(a) Data Accuracy and Quality of GIS Data & Measuring Spatial Data Quality**

1. **Data Accuracy**:
   * Refers to how closely data matches the true location or value.
2. **Data Quality**:
   * Refers to the reliability, consistency, and completeness of the data.
3. **Measuring Spatial Data Quality**:
   * Positional accuracy, attribute accuracy, completeness, consistency, temporal accuracy.

**(b) Geospatial Data Validation and Cleansing**

1. **Validation**:
   * Ensures that spatial data is accurate, reliable, and conforms to standards.
2. **Cleansing**:
   * Removes duplicate records, incorrect values, and inconsistencies in datasets.

**(c) What is WGS84?**

* WGS84 (World Geodetic System 1984) is a global geodetic coordinate system.
* It serves as the standard reference for GPS and is used to define positions on Earth's surface with latitude, longitude, and elevation.