What is GIS?

GIS (Geographic Information System) is a computer-based system used to collect, store, analyze, manage, and display spatial (geographic) data.

Simple Definition: GIS = Computer + Map + Data + Analysis

⊘ Concepts of GIS:

- Spatial data: Data related to location (e.g., river, road, building).
- Attribute data: Data describing spatial features (e.g., river name, road type).
- Layers: Data is stored in map layers (e.g., roads layer, rivers layer).
- **Query and analysis:** GIS helps answer spatial questions like "Where is the nearest hospital?"

⊘ Components of GIS:

1) Hardware:

- → Physical equipment used in GIS operations.
- → Includes: Computers, GPS devices, plotters, digitizers, printers, servers.

2) Software:

- → Programs used to process and analyze spatial data.
- → Examples: ArcGIS, QGIS, GRASS GIS
- → Performs functions like input, editing, analysis, and map creation.

3) <u>Data:</u>

- → Most crucial component of any GIS.
- \rightarrow Two types:
 - Spatial data (maps, coordinates)
 - Attribute data (name, population, land type)

4) People:

- → GIS professionals, analysts, users, decision-makers who design and operate the system.
- → Their skills and knowledge are essential to get meaningful output from GIS.

5) Methods:

- → Set of rules, models, and procedures used to collect, analyze, and interpret geographic data.
- → Includes standardized workflows and techniques.

1.2 Origin of GIS, History of GIS and Geospatial Technology

Origin of GIS:

- Began in the 1960s
- First true GIS: Canada Geographic Information System (CGIS) developed by Roger
 Tomlinson (known as "Father of GIS")

☑ History Timeline:

Year	Event
1960s	CGIS created
1980s	GIS software became commercially available (like
	Arc/Info)
1990s	Internet GIS started
2000s	Open Source GIS and mobile GIS became popular

1. Data Capture:

→ GIS collects spatial and attribute data from various sources like GPS, satellite images, surveys, and remote sensing.

2. Data Storage:

ightarrow Stores large volumes of spatial and attribute data in databases for easy retrieval and processing.

3. Data Management:

- → Organizes, updates, and maintains data using database management systems (DBMS).
- → Ensures data integrity and consistency.

4. Spatial Analysis:

→ Performs spatial queries and analysis such as overlay, buffering, proximity analysis, and pattern detection.

→ Helps in identifying relationships between geographic features.

5. Visualization and Map Display:

- \rightarrow Converts raw data into visual formats like maps, graphs, and 3D models.
- → Enhances understanding and supports better decision-making

☑ Benefits of GIS:

- Better decision-making
- Improved communication (maps are easy to understand)
- Saves time and cost
- Helps in disaster management, urban planning, and natural resource management
- Effective Resource Management.

Major Applications:

• <u>Marian Planning:</u>

- → Used to plan cities, roads, water supply, and electricity lines.
- \rightarrow Example: Making a map for new roads in a city.

• <u></u> # Agriculture:

- \rightarrow Helps farmers know the best places to grow crops.
- → Example: Checking soil and rainfall data for farming.

• <u>C Disaster Management:</u>

- → Used to find risky areas and plan rescue during floods or earthquakes.
- → Example: Making safe routes for people during floods.

• \(\subseteq \text{Environment Protection:} \)

- → Used to track pollution, forest loss, and animal habitats.
- → Example: Checking areas where trees are being cut.

Health Sector:

- → Helps track disease spread and plan hospitals.
- → Example: Mapping dengue or COVID-19 cases in a city.

🖈 1.5 Database Management System (DBMS), Spatial and Attribute Data

What is DBMS?

A **Database Management System (DBMS)** is software to **store, organize, and manage** data efficiently.

✓ In GIS:

- **Spatial Data** Data with location (points, lines, polygons)
 - o Example: Road (line), River (line), Building (polygon)
- Attribute Data Describes properties of spatial data
 - o Example: Road name, River length, Building type

Example:

Spatial = "School" (point on the map)

Attribute = "School Name: ABC School, Type: Secondary".