Introduction :- Geographical Information System (GIS)

* Definition :-

A GIS is a computer system for capturing, storing, querying, analysing & displaying geospatial data.

Geospatial data :- Geographically referenced data that describes both the location and characteristics of spatial features such as roads, land parcels, and vegetation stands on earth's surface.

The ability of a GIS to handle and process geospatial data distinguishes GIS from other information systems.

* Components of GIS :-

1) Computer system
2) GIS software
3) People
4) Data
5) Infrastructure

1) Computer System :- The computer system includes the computer ~~system~~ and the operating system to run GIS. Typically the choices are PC's that use the windows operating system (e.g. Windows 2000, XP, 7, 8, 10 etc) or workstations that use the UNIX or Linux operating system. Additional equipment may include monitors for display, digitizers & scanners for spatial data input, GPS receivers, & mobile devices for fieldwork & Printers and plotters

for hard-copy data display.

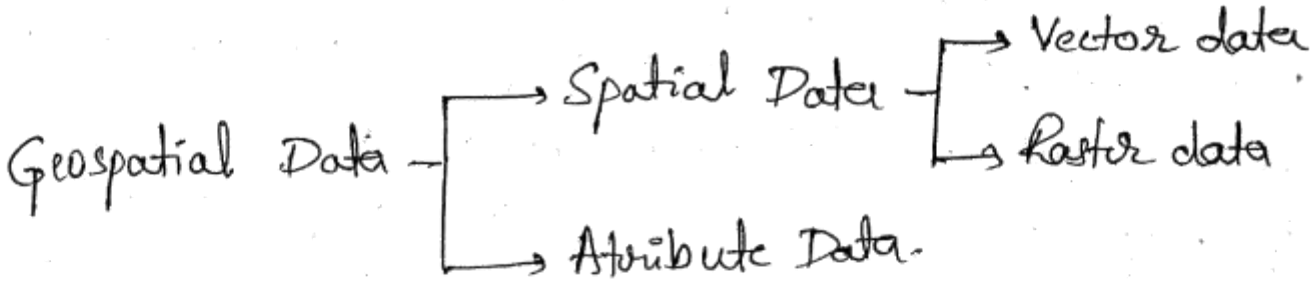
2) GIS software :- The GIS software includes the program & the user interface for driving the hardware. Common user interfaces in GIS are menus, graphical icons, command lines & scripts.

3) People :- People refers to GIS professionals & users who define the purpose & objectives and provide the reason and justification for using GIS

4) Data :- Data consist of various kind of inputs that the system takes to produce information

5) Infrastructure :- It refers to the necessary physical, organizational, administrative, & cultural environments that support GIS operations. The infrastructure includes requisite skills, data standards, data clearing houses and general organizational patterns.

Data structures in GIS.



- Geospatial data comprise the spatial and attribute components. So that Geospatial data is the combination of both spatial data and attribute data

i) Spatial data :-

Spatial data describe the location of spatial features, which may be discrete or continuous.

Discrete features are individually distinguishable features that do not exist between observations Discrete features includes points (e.g. wells), lines (e.g. roads) and areas (e.g. land use types).

Continuous features are features that exist spatially between observations.

Example :- Elevation, & Precipitation.

A GIS represents these spatial features on the earth's surface as map features on a plane surface. This transformation involves two main issues : the Spatial reference system and the data model.

Spatial reference System:

The locations of spatial features on the earth's surface are based on a geographical coordinate system with longitude & latitude values, whereas the location of map features are based on a plane co-ordinate system with x-, y- cordinates. Projection is the process that can transform the earth's spherical surface to a plane surface and bridge the two spatial reference system.

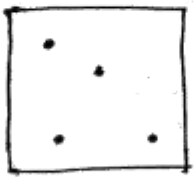
Data model:

The data model defines how spatial features are represented in a GIS. Three areas Spatial features can be ~~expressed~~ represented by using two data models, they are

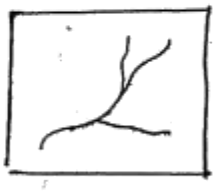
1) Vector data model
2) Raster data model.

The Vector data model uses points and their x-, y- co-ordinates to construct spatial features of points, lines and areas. Vector data are ideal for representing discrete features

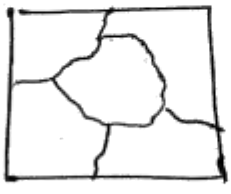
Ex:-



· Point feature

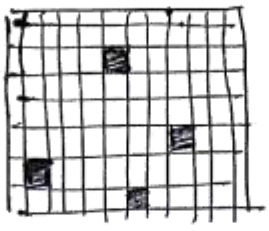


Line feature

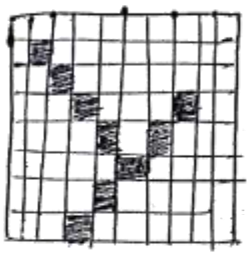


Area feature

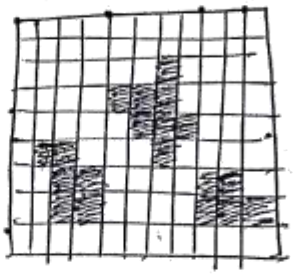
Raster data model : Uses a grid and grid cells to represent the spatial variation of a feature. Raster data are better suited for representing continuous features. The raster data model uses a simple data structure with rows and columns and fixed cell locations.



Point feature



Line feature



Area feature

ii) Attribute data : – (Information about feature)

Attribute data describe the characteristics of spatial features. For raster data, each cell has a value that corresponds to the attribute of the spatial feature at that location. A cell is tightly bond to its cell value. For vector data, the amount of attribute data to be associated with a spatial feature can vary significantly.

A road segment may only have the attributes of length and speed limit, whereas a soil polygon may have dozens of properties, interpretations & performance data. Attribute data is organised by row & column. Each row represents spatial feature & each column/field describes a characteristics of respective feature.

★ GIS Operations / Functions of GIS :—

1) Spatial data input
   i) Data entry: Use existing data, Create new data
   ii) Data editing
   iii) Geometric transformation.
   iv) Projection & reprojection.

2) Attribute data Management
   i) Data entry & verification
   ii) Database Management
   iii) Attribute data Manipulation

3) Data ~~exploration~~ display
   i) Cartographic Symbolization
   ii) Map design

4) Data exploration
   i) Attribute data query
   ii) Spatial data query
   iii) Geographic visualization

5) Data analysis
   i) Vector data analysis :
   ii) Raster data analysis
   iii) Terrain mapping & analysis
   iv) Watershed analysis.

v) Spatial interpolation
vi) Geocoding
vii) Path & Network analysis.

6) GIS Modeling
   i) Binary models
   ii) Index Models
   iii) Regression models
   iv) Process models

★ Layer concept in GIS & Overlay of layers.

A layer is a GIS database containing groups of Point, line or area features representing a particular type of real world entities such as customers, streets, postal codes, boundary & topographic features etc. A layer contains both the visual representation of each feature & a link from the feature to its database attributes. Maps in GIS are made by combining multiple layers.

Ex:-