6th SEMESTER (MAJOR)

PAPER 604: PRINCIPLES AND APPLICATION OF REMOTE SENSING, GIS AND GPS

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UNIT 2: GEOGRAPHICAL INFORMATION SYSTEM

NATURE AND TYPES OF GEOGRAPHIC DATA: SPATIAL AND NON-SPATIAL

We use the terms "data" and "information" interchangeably but these two terms actually convey very distinct concepts. "Data" is defined as a body of facts or figures which have been gathered systematically for one or more specific purposes. Data is a plural and are the things we want to store in a database. "Information" is defined as data which have been processed into a form that is meaningful. It is data that make information useful for one person and same information may not be useful to another person.

Geographic data are a special type of data because of their geographic in nature. The geographic data are geographically referenced wherein we can locate and identify features by a spherical coordinate system (latitude and longitude). They are made up of descriptive elements (which tell what they are) and graphical elements (which tell what they look like, where they are found and how they are spatially related to one another). The descriptive elements are commonly referred to as non-spatial data while the graphical elements are commonly referred to as spatial data. The geographic data are always pertinent to features and resources of the Earth as well as human activities based on or associated with these features and resources. The primary purpose of collection of geographical data and their utilisation is for problem solving and decision making associated with geography, i.e. location, distribution and spatial relationships within a particular geographical framework. On the other hand, processing of geographic data results in geographic information. The geographic information is useful to improve the user's knowledge about the geography of the Earth's features and resources as well as human activities associated with these features and resources. It enables the user's to develop spatial intelligence for problem solving and decision-making concerning the occurrence, utilisation and conservation of the Earth's features and resources as well as impacts and consequences of human activities associated with them. Spatial nature and characteristics of geographic data, generic concepts of information organisation and data structure cannot be applied directly to them. Geographic data have three dimensions which are given below:

a) temporal (e.g., 26th December, 2004)

b) thematic (e.g., occurrence of tsunami in Indian ocean), and

c) spatial (e.g., affected area including southeastern coast of India).

GIS emphasises the use of spatial dimension for turning data into information which assist our understanding of geographic phenomena.

Geographic data are classified into two types- Spatial data and Non-spatial data.

Spatial Data:

Spatial data is geographical representation of features. In other words, spatial data is what we actually see in the form of maps (containing real-world features) on a computer screen. Spatial data can further be divided into two types- **vector** and **raster data**.

Vector Data: Vector data represents any geographical feature through point, line or polygon or combination of these.

1. Point: A point in GIS is represented by one pair of coordinates (X,Y). It is considered as dimension-less object. Most of the times a point represent location of a feature (like cities, wells, villages etc.).

2. Line: A line or arc contains at least two pairs of coordinates (say- X1, Y1 & X2, Y2). In other words a line should connect minimum two points. Start and end points of a line are referred as nodes while points on curves are referred as vertices. Points at intersections are also called as nodes. Roads, railway tracks, streams etc. are generally represented by line.

3. Polygon: In simple terms, polygon is a closed line with area. It takes minimum three pairs of coordinates to represent an area or polygon. Extent of cities, forests, land use etc. is represented by polygon.

Raster Data: Raster data is made up of pixels. It is an array of grid cells with columns and rows. Each and every geographical feature is represented only through pixels in raster data. There is nothing like point, line or polygon. If it is a point, in raster data it will be a single pixel, a line will be represented as linear arrangement of pixels and an area or polygon will be represented by contiguous neighbouring pixels with similar values.

In raster data one pixel contain only one value (unlike vector data where a point, a line or a polygon may have number of values or attributes) that's why only one geographical feature can be represented by a single set of pixels or grid cells. Hence a number of raster layers are required if multiple features are to be considered (For example- land use, soil type, forest density, topography etc.).

Non-spatial (Attribute data):

Attributes attached to spatial data are referred to as non-spatial data. Whatever spatial data we see in the form of a colourful map on a computer screen is a presentation of information which remains stored in the form attribute tables. Attributes of spatial data must contain unique identifier for each object. There may be other field also containing properties/information related a spatial feature. Attribute table of spatial data also contains 'x' and 'y' location (i.e. latitude/longitude or easting/northing) of features; however in some GIS software these columns may remain 'invisible'.

Let us illustrate this with the help of an example. The non-spatial data of town comprise of name of the town, its population, settlement type, means of transportation and communication, administration set-up, education institutions, occupations and facilities. It is important to note that

all the above mentioned data of town are not dependent on their location identities. Hence, non-spatial data is independent from location information.

The basic difference between spatial and non-spatial data is that the spatial data is multi-dimensional in nature and auto correlated, whereas, non-spatial is one-dimensional in nature and independent.