

6th SEMESTER (MAJOR)

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

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UNIT 2: GEOGRAPHICAL INFORMATION SYSTEM

FUNCTIONAL UNITS OF GIS

A GIS is a system of hardware, software and procedures to facilitate the management, manipulation, analysis, modelling, representation and display of georeferenced data to solve complex problems regarding planning and management of resources. Geographic information systems have emerged in the last decade as an essential tool for urban and resource planning and management. Their capacity to store, retrieve, analyse, model and map large areas with huge volumes of spatial data has led to an extraordinary proliferation of applications. Geographic information systems are now used for land use planning, utilities management, ecosystems modelling, landscape assessment and planning, transportation and infrastructure planning, market analysis, visual impact analysis, facilities management, tax assessment, real estate analysis and many other applications.

Geographic Information Systems are software used for the effective database storage of geographic data, its transformation of one data format to another, its pictorial or model representation and its analysis and manipulation. Technically, a GIS can be classified into five functional units.

1. The Database functional unit
 2. The Data Transformation functional unit
 3. The Data Manipulation functional unit
 4. The Data Analysis functional unit
 5. The Data Representation functional unit
1. The **Database function** of the GIS performs Geographic data storage, data organisation and data retrieval tasks. The functions of database govern the creation of an access to the database itself. These functions provide consistent methods for data entry (manual digitising, scanning, keyboard entry of attribute information, and online retrieval from other database systems), update, deletion, and retrieval. Modern database management systems isolate the users from the details of data storage, such as, the particular data organisation on a mass storage medium. A modern Database Management System (DBMS) is used to create GIS database, that is, attribute database. Storage and retrieval mechanisms include the control of physical storage of the data in memory, disk or tape, and mechanisms for its retrieval to serve the needs of the other three components. In a disaggregate GIS this data storage may be physically more from the rest of the system, and may meet the database requirements. This module includes the software structures used to organise spatial data into models of geographic reality.

2. The **Data Transformation function** of the GIS performs the task of preparing Geographic data for use within the GIS. Raw or legacy Geographic data is transformed into a Geographic data format supported by the GIS.
3. The **Data Manipulation function** of the GIS performs tasks related to finer adjustments and rectification of the Geographical data. For example, an aerial photograph may have the need to be stretched (orthorectified) so that its pixels align with longitude and latitude specifications of the Geometric projection in use. Processes like these must be distinguished from Geographic Data Transformation by the fact that these changes are permanent, more complex and time consuming.
4. The **Data Analysis function** of the GIS performs all the tasks of data processing that help the analyst make specific sense out of the Geographic data. The analytical functions which most GIS software provides operate on both the spatial or the attribute data (or a combination of these). Most of the following analyses can be performed on both vector or raster structured data, though inevitably one or other of these is more efficient depending on the actual analysis being performed. For illustration, the histogram function prepares a histogram of the input pixel data of the image and gives out a plot that helps the analyst plot important characteristics about the data under processing.
5. The **Data Representation function** of the GIS handles the representation of the Geographic data in pictorial or model form for comprehension. A major anticipated use for any GIS will be to display the data, i.e. the display capacity will represent the output from the system as presented initially on the VDU. A fundamental usefulness of the concept of GIS is that it can display output at any stage in the processing of the data. In this phase the final outputs from the GIS are created. These output products might include statistical reports, maps, and graphics of various kinds. Some of these products are softcopy images and hardcopy.

