UNIT I FUNDAMENTALS OF GIS 9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT I / Part - A

1.	**What is Geographic Information System?** It's a computer based information system primarily aims collecting, classifying, crosschecking, manipulating, interpreting, retrieving and displaying data which are spatially referred to the earth in an appealing way.
2.	**What are the components of GIS?** i)The Computer System (Hardware and Operating System) ii)The Software iii) Spatial Data iv)Data Management and analysis procedures v) The People to operate the GIS
3.	**What are the GIS softwares used?** Standard GIS Software's • ARCGIS • ARCVIEW • ARCINFO • MAPINFO • ERDAS • ENVI • AUTOCADMAP • IDRISI
4.	**What are all the Elements of GIS?** • Geospatial data • Data acquisition • Attribute data management • Data Display • Data exploration • Data analysis
5.	**What are the applications of GIS?** Real World Example Applications of GIS: • Disaster Management. Hurricane Katrina is seen by many as the first time that GIS was used a disaster management tool. • Crime Statistics. • Archaeology. • Civic Planning. • Health / Medical Resource Management. • Transport.
6.	**What do you mean by Geospatial data?** By definition, geospatial data cover the location of spatial features. To locate spatial features on the Earth's surface, we can use either a geographic or a projected coordinate system. A geographic coordinate system is expressed in longitude and latitude and a projected coordinate system in x, y coordinates. Many projected coordinated systems are available for use in GIS. An example is the Universal Transverse Mercator (UTM) grid system, which divides the Earth's surface between 84°N and 80°S into 60 zones.
7.	**What is Attribute Data Management?** A GIS usually employs a database management system (DBMS) to handle attribute data, which can be large in size in the case of vector data. Attribute data are stored in a relational database as a collection of tables. These tables can be prepared, maintained, and edited separately, but they can also be linked for data search and retrieval.
8.	**Define Data Exploration.** Data exploration refers to the activities of visualizing, manipulating, and querying data using maps,tables, and graphs. These activities offer a close look at the data and function as a precursor to formal data analysis.

9.	**What are the types in Data Exploration?** Data exploration in GIS can be map or feature-based. • Map-based exploration includes data classification, data aggregation, and map comparison. • Feature-based query can involve either attribute or spatial data
10.	**What is Geographic Co-Ordinate System?** The geographic coordinate system is the reference system for locating spatial features on the Earth's surface. The geographic coordinate system is defined by longitude and latitude. Both longitude and latitude are angular measures: longitude measures the angle east or west from the prime meridian, and latitude measures the angle north or south of the equatorial plane
11.	**What are the characteristics of map?** • maps are often stylized, generalized or abstracted, requiring careful interpretation • usually out of date show only a static situation - one slice in time • often highly elegant/artistic
12.	**Write the necessity of map projection?** Projection is necessary one because spatial entities locate in two dimensions. The method by which the "world is laid flat" is used to help projection. Doing the process introduce error into spatial data. Spatial data character varies depending on the projection method chosen. Shape and distance are distorted the accuracy world is spherical shape visualize the two dimension in flat surface is difficult.
13.	**Write the types of map projection?** 1. An azimuthal or planar projection 2. A cylindrical projection 3. A conic projection **4.** Mathematical map projection
14.	**Write few lines about cylindrical projection?** • Countries near the equator in true relative portion. • Distance increases between countries located towards top and bottom of mage. • The view of the poles is very distorted. • Area for the most part is preserved.
15.	**Write few lines about conical projection?** • Area is distorted • Distance is very distorted towards the bottom of the image • Scale for the most part is preserved
16.	**Write few lines about azimuthal projection?** • Only a part of the earth surface is visible. • The view will be of half the globe or less. • Distortion will occur at all four edges. • Distance for the more part is preserved.
17.	**What is referencing system?** Referencing system is used to locate a feature on the earth's surface or a two dimension representation of this surface such as a map.
18.	**What are the methods of spatial referencing systems?** Geographical co-ordinate system, Rectangular co-ordinate system & Non-co-ordinate system
19.	**Define Datum.** A **datum** is a mathematical model of the Earth, which serves as the reference or base for calculating the geographic coordinates in the case of a horizontal datum and for calculating elevations in the case of a vertical datum.
20.	**What is Datum Shift?** A change from one datum to another, such as from NAD27 to NAD83, which can result in substantial horizontal shifts of point positions.

21.	**How to Measure Distances on the Earth's Surface?** The standard and simplest method for calculating the shortest distance between two points on the Earth's surface, also called geodesic distance, uses the equation: $\cos(d) = \sin(a)\sin(b) + \cos(b) + \cos(c)$ where d is the angular distance between points A and B in degrees, a is the latitude of A, b is the latitude of B, and c is the difference in longitude between A and B. To convert d to a linear distance measure, one can multiply d by the length of 1 degree at the equator, which is 111.32 kilometers or 69.17 miles. This method is accurate unless d is very close to zero.
22.	**What is Transverse Mercator projection?** A common map projection, which is the basis for the UTM grid system and the SPC system.
23.	**What is Universal Polar Stereographic (UPS) grid system?** A grid system that divides the polar area into a series of 100,000-meter squares, similar to the UTM grid system.
24.	**What is Universal Transverse Mercator (UTM) grid system?** A coordinate system that divides the Earth's surface between 84° N and 80° S into 60 zones, with each zone further divided into the northern hemisphere and the southern hemisphere.
25.	**What is Spatial Data? List the basic Spatial Data types.** It is the data or information that identifies the geographic location of features and boundaries on Earth, such as natural or constructed features, oceans , and more . Spatial data is usually stored as coordinate and topology, and is data that can be mapped. The two basic spatial data types are: • Raster data,Vector data
26.	**What is Vector data?** Vector data uses two dimensional Cartesian coordinates to store the shape of spatial entity. Vector based features are treated as discrete geometric objects over the space.In the vector data base point is the basic building block from which all the spatial entities are constructed.
27.	**What is raster data?** Raster is a method for the storage, processing and display of spatial data. Each area is divided into rows and columns, which form a regular grid structure. Each cell must be rectangular in shape, but not necessarily square.
28.	**What is the Difference between Attribute Data and Spatial Data?** Attribute data refers to the characteristics of geographical features that are quantitative and/or qualitative in nature while spatial data refers to all types of data objects or elements that are present in a geographical space or horizon.
29.	**What are the different scales of measurement?** Measurement scales are used to categorize and/or quantify variables. Commonly used statistical analysis are: nominal, ordinal, interval, and ratio scales.
30.	**What is Attribute data and list out the types in it?** Attribute data is information appended in tabular format to spatial features. The spatial data is the where and attribute data can contain information about the what, where, and why. Attribute data provides characteristics about spatial data. Attribute data can be store as one of five different field types in a table or database: character, integer, floating, date, and BLOB.
	UNIT-I / PART-B
1.	**Explain the functions of GIS. What are the applications and limitations of GIS.**
2.	**Explain in detail about the Elements of GIS.**
3.	**Discuss in detail about the basic components of GIS.**
4.	**What is map projection and explain the differentiate types of map projections with their characteristics.**
5.	**Briefly explain about Transverse Mercator and Lambert Conformal Conic Map Projection.**

6.	**Explain Albers Equal –Area conic , Equidistant conic and Web Mercator Map projection in detail.**
7.	**Explain in detail about the UTM projection system.**
8.	**Illustrate the Universal Polar Stereographic Grid System in detail.**
9.	**Briefly explain the concepts of SPC system and PLSS.**
10.	**Write a short notes on,** **(i) Spatial & attribute data (ii) Geographic scale (iii) Requirements of GIS**
11.	**Explain the various levels of measurement in GIS?**

UNIT II SPATIAL DATA MODELS 9

Database Structures – Relational, Object Oriented – Entities-ER diagram - Data models - conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.

UNIT II/ PART-A

1.	**What is a database in GIS?** A database management system (DBMS) serves as an interface between users and their database. A spatial database includes location. It has geometry as points, lines and polygons. GIS combines spatial data from many sources with many different people. Databases connect users to the GIS database.
2.	**What is GIS database design?** Database design is the process of producing a detailed data model of a database. This logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a data definition language, which can then be used to create a database.
3.	**Define data model.** Data models are the conceptual models that describe the structures of databases. Structure of a database is defined by the data types, the constraints and the relationships for the description or storage of data.
4.	**Write short notes on Relational Data Structure Model** The relational database relates or connects data in different files through the use of a common field. A flat file structure is used with a relational database model. In this arrangement, data is stored in different tables made up of rows and columns. The columns of a table are named by attributes. Each row in the table is called a tuple and represents a basic fact.
5.	**Mention the advantages of Relational Database structure.** The manager or administrator does not have to be aware of any data structure or data pointer. One can easily add, update, delete or create records using simple logic.
6.	**Define ER model.** The entity relationship (ER) model represents the conceptual design of a database. The ER diagram helps in understanding the components of a database and relationships among them. In ER diagram attributes are represented by ovals attached to the entity by a line.
7.	**Define Cardinality** A relationship is an association among entity types. Cardinality denotes the occurrences of data on either side of a relation. The cardinality ratio for a binary relationship specifies the maximum number of relationship instances an entity can participate in.
8.	**List the features of Object data model which make them good for modelling GIS systems.** ✓ **Encapsulation**: packaging together of the description of state and behavior in each object ✓ **Inheritance**: ability to use some or all characteristics of one object in another object ✓ **Polymorphism**: Specific implementation of operations such as create, delete etc for each object.
9.	**Define Spatial and Non spatial data.** Spatial data refers to the data or information that describes the absolute or relative location of geographic features on the earth. The non spatial data or the attribute data on the other hand

	describes the characteristics of the spatial features. These characteristics can be quantitative or qualitative
10.	**Define Vector data model.** Data models describe the representation and storage of the geographic data. Vector data model is closely linked with the discrete object view. In vector data model, geographical phenomena are represented in three different forms;-point, line and polygon. The shape of a spatial entity is stored using two-dimensional (x, y) coordinate system.
11.	**Define Raster data model.** The raster data model is commonly associated with the field conceptual model. Here, geographic space is represented by array of cells or pixels (aka picture elements) which are arranged in rows and columns. Each pixel has a value that represents information. The value can be in the form of integer, floating points or alphanumeric.
12.	**List the topological features of Vector data structure.** A topology is a mathematical procedure that describes how features are spatially related and ensures data quality of the spatial relationships. Topological relationships include following three basic elements: ✓ **Connectivity**: Information about linkages among spatial objects ✓ **Contiguity**: Information about neighboring spatial object ✓ **Containment:** Information about inclusion of one spatial object within another spatial object
13.	**Mention the features of Arc Node topology in Vector data structure.** Arc node topology defines connectivity - arcs are connected to each other if they share a common node. This is the basis for many network tracing and path finding operations. Arcs represent linear features and the borders of area features. Every arc has a from-node which is the first vertex in the arc and a to-node which is the last vertex. These two nodes define the direction of the arc. Nodes indicate the endpoints and intersections of arcs. They do not exist independently and therefore cannot be added or deleted except by adding and deleting arcs.
14.	**Define Raster data structure** In a simple raster data structure the geographical entities are stored in a matrix of rectangular cells. A code is given to each cell which informs users which entity is present in which cell. The simplest way of encoding a raster data into computers can be understood by Entity Model, Pixel Values and File Structure.
15.	**What are the advantages of Raster data model?** ✓ Simple data structure ✓ Compatible with remote sensing or scanned data ✓ Spatial analysis is easy ✓ Simulation is easy because each unit has the same size and shape
16.	**What are the advantages of Vector data model?** ✓ Data is represented at its original resolution and form without generalization ✓ Requires less storage space ✓ Editing is faster and convenient ✓ Network analysis is fast ✓ Projection transformations are easier
17.	**What are the steps involved in Chain encoding?** Chain encoding works by defining boundary of the entity i.e. sequence of cells starting from and returning to the given origin. Direction of travel is specified using numbers. (0 = North, 1 = East, 2 = South, 3 = West). The first line tells that the coding started at cell (4, 2) and there is only one chain. In the second line the first number in the pair tells the direction and the second number represents the number of cells lying in this direction.
18.	**Define hull in TIN data model?** The hull of the TIN is formed by one or more polygons containing the entire set of data points

	used to construct the TIN. The hull polygons define the zone of interpolation of the TIN. Inside or on the edge of the hull polygons, it is possible to interpolate surface z values, perform analysis, and generate surface displays. Outside the hull polygons, it is not possible to derive information about the surface. The hull of a TIN can be formed by one or more polygons, which can be non-convex.
19.	**Define TIN Data model.** TIN represents surface as contiguous non-overlapping triangles created by performing Delaunay triangulation. These triangles have a unique property that the circumcircle that passes through the vertices of a triangle contains no other point inside it. TIN is created from a set of mass points with x, y and z coordinate values. This topologic data structure manages information about the nodes that form each triangle and the neighbors of each triangle.
20.	**What are the advantages of Delaunay triangulation** ✓ The triangles are as equiangular as possible, thus reducing potential numerical precision problems created by long skinny triangles ✓ The triangulation is independent of the order the points are processed ✓ Ensures that any point on the surface is as close as possible to a node
	UNIT-II/PART-B
1.	**Discuss about Relational database structure in GIS with example.**
2.	**Mention the various Data Structure models in GIS. Explain them with example**
3.	**Describe Object Oriented Database structure.**
4.	**Explain Entity Relationship model with examples.**
5.	**Describe the topological features of Vector Data Structure.**
6.	**Explain in detail Raster Data Structure.**
7.	**Explain the various data compaction methods used in Raster data structure.**
8.	**Compare Raster and Vector Data Model. Mention their advantages and disadvantages.**
9.	**Describe TIN Data model and its advantages.**
10.	**Describe GRID Data model with example.**
UNIT III	**DATA INPUT AND TOPOLOGY** **9** Scanner – Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input – Digitiser – Datum Projection and reprojection -Coordinate Transformation – Topology – Adjacency, connectivity and containment – Topological Consistency – Non topological file formats – Attribute Data linking –Linking External Databases– GPS Data Integration
	UNIT III/ PART-A
1.	**What is GIS data and its types** Two major families of GIS data are Raster & Vector Raster is grid based Vector is ->coordinate based (Cartesian,polar,3D,linear), Topological, object oriented
2.	**What is a Shapefile?** The shapefile format is now a common format for storing vector GIS data. Shapefiles store non-topological vector data along with related attribute data. Developed by Esri, shapefiles are now an open format and is a popular option for data transfer. For example, shapefiles can be directly read by a number of GIS software programs such as ArcGIS and QGIS
3.	**Compare shapefile and geodatabase approach** There are two basic ways to do structure and store your GIS data. These are the 'Shapefile Approach' and the Geodatabase Approach'. The Shapefile Approach uses the almost-universally accessible shapefile format for vector data layers (and similarly widely used formats for raster data layers) to store data layers in a single folder, usually on the C: drive of computer (if you are running a Windows operating system). This information can then be accessed with almost any GIS software package.

	In contrast, the Geodatabase Approach is specific to ESRI's ArcGIS software package. In it, all the data layers in a GIS project are stored in a single, specially formatted geodatabase file on your computer and can only be accessed with ArcGIS.
4.	**What is digitizing and its types** Digitizing in GIS is the process of converting geographic data either from a hardcopy or a scanned image into vector data by tracing the features. During the digitzing process, features from the traced map or image are captured as coordinates in either point, line, or polygon format. There are several types of digitizing methods. Manual digitizing & Heads up digitizing (also referred to as on screen digitizing
5.	**What is manual and Heads up digitizing?** In this method, the digitizer uses a digitizing tablet (also known as a digitizer, graphics tablet, or touch tablet) to trace the points, lines and polygons of a hard-copy map. This is done using a special magnetic pen, or stylus, that feeds information into a computer to create an identical, digital map. Manual Digitizing is still a useful technique because of its ability to accurately copy maps in poor condition. **Heads-up Digitizing-**This method involves scanning a map or image into a computer. The digitizer then traces the points, lines and polygons using digitizing software. This method of digitizing has been named "heads-up" digitizing because the focus of the user is up on the screen, rather than down on a digitizing tablet.
6.	**What is Georeferencing?** Georeferencing is the process of taking a digital image, it could be an air photo, a scanned geologic map, or a picture of a topographic map, and adding geographic information to the image so that GIS or mapping software can 'place' the image in its appropriate real world location. This process is completed by selecting pixels in the digital image and assigning them geographic coordinates.
7.	**What is a Geodatabase and its types?** A geodatabase is an alternate way to store GIS information in one large file, which can contain multiple point, polygon, and/or polyline layers. The geodatabase is a "container" used to hold a collection of datasets. A **geodatabase** is a database designed to store, query, and manipulate geographic information and spatial data. It is also known as a **spatial database**. Geodatabases often appear as single files with the ".gdb" extension or ".mdb" extension.
8.	**Differentiate the Geodatabases types?** 1. File geodatabases—Stored as folders in a file system. Each dataset is held as a file that can scale up to 1 TB in size. The file geodatabase is recommended over personal geodatabases. 2. Personal geodatabases—All datasets are stored within a Microsoft Access data file, which is limited in size to 2 GB. **3.** Enterprise geodatabases—Also known as multiuser geodatabases, they can be unlimited in size and numbers of users. Stored in a relational database using Oracle, Microsoft SQL Server, IBM DB2, IBM Informix, or PostgreSQL.
9.	**Differentiate raster data and vector data** Raster and vector are the two basic data structures for storing and manipulating images and graphics data on a computer.Raster images come in the form of individual pixels, and each spatial location or resolution element has a pixel associated where the pixel value indicates the attribute, such as color, elevation, or an ID number. Raster images are normally acquired by optical scanner, digital CCD camera and other raster imaging devices. Vector data comes in the form of points and lines that are geometrically and mathematically associated. Points are stored using the coordinates. The main **difference between vector and raster** graphics is that **raster** graphics are composed of pixels, while **vector** graphics are composed of paths.
10.	**What are the elements of topological relationships.** **Connectivity** ✓ Information about linkages among spatial objects y

	✓ Keep track of which links are connected at a node **Adjacency** ✓ Information about neighborhood among spatial objects ✓ A link can determine the polygon to its left and its right **Containment** ✓ Information about inclusion of one spatial object within another spatial object ✓ What nodes and links and other polygons are within a polygon
11.	**Define topology** Topology basically refers the relationship between things, and in the realm of GIS, Topology refers to the relationship between spatial features or objects.
12.	**What is topology rules** A topology rule can monitor spatial relationships of features in a single feature class, or the relationships that exist between feature classes. Topologies rule can be removed anytime. Rules are not applied until a topology is validated. Topology rules example: Polygon rule, Line Rule, Point Rules
13.	**Why topology is important to GIS?** First, topology is necessary for certain spatial functions such as network routing through linear networks. Second, topology can be used to create datasets with better quality control and greater data integrity. Third, by creating topological relationships between feature classes, features can be shared across feature classes.
14.	**What is topology validating** Validating the topology means checking the features to identify any violations of the rules that have been defined for the topology.Validating the topology also starts the cracking and clustering process.Validate the whole topology, validate the visible extent of your map, or drag a box around the area to validate.
15.	**What is topology errors** Topological errors violate relationships that are defined by the user or required by a GIS package. Common topological errors: Polygon Errors ->Unclosed gaps • Gaps between polygons • Overlapping polygons Line Errors->Do not meet at node,Pseudo node and point errors
16.	**What is attribute data** Attribute data are stored in tables. An attribute table is organized by row and column. Each row represents a spatial feature, each column describes a characteristic, and the intersection of a column and a row shows the value of a particular characteristic for a particular feature.
17.	**What are the Types of Attribute Data** One method for classifying attribute data is by data type. Common data types are number, text (or character), date, and binary large object (BLOB). Another method is to define attribute data by measurement scale. The measurement scale concept groups attribute data into nominal, ordinal, interval, and ratio data, with increasing degrees of sophistication.
18.	**What is GPS and GIS** GPS – (Global Positioning System) A device for measuring geographic coordinates at any location on the earth. GPS is a satellite navigation system designed to provide accurate position, velocity, and time information almost anywhere in the world.

	GIS – (Geographic Information System) A database for maintaining and analyzing spatial features and the relationships between features as they are defined through geographic coordinates or measurements.
19.	**Compare GPS and chart plotter.** GPS provides your location, but it doesn't show it on a map. A chartplotter takes the GPS location and places it on top of a map. All chartplotters use GPS, but not all GPS are chartplotters. A chartplotter is typically a stand-alone computer that is able to show a map and plot significant objects or places on it.
20.	**What is Datum Projection?** A datum projection, often referred to simply as a "projection," is a method used to represent the Earth's three-dimensional, curved surface on a two-dimensional map or computer screen. This process involves transforming the geographical coordinates of points on the Earth's surface into a flat, Cartesian coordinate system, which is essential for displaying and analyzing spatial data.
21.	**What is GIS Scanning** The process of conversion of paper maps into digital format usable by computer is known as Scanning. It is used to convert an analog map into a scanned file, which is again converted to vector format through tracing. Scanning automatically captures map features, text and symbols as individual cells, or pixels and produces an automated image.
22.	**List & explain GIS scanning types.** Scanning is mainly of two types: B**lack and White Raster Scanning:** It is the simplest type of scanning and can be used on line drawings, text or any one colored document. It is used in Archival Drawing Libraries, Electronic Document Distribution and Vectorization Templates. **Grey Scale and Color Raster Scanning**: It is used for large size documents. Its applications include capturing images for use in desktop publishing, full color maps, aerial photography, Toposheets and cartographic base data for "high end" mapping system.
	UNIT-III/PART-B
1.	**Explain Four Data Input Techniques in GIS**
2.	**List the raster data file formats.**
3.	**Explain commonly used topology rules.**
4.	**How topologies are built in GIS?**
5.	**Explain Topology validation and topology errors.**
6.	**Explain Topological Relationships between Spatial Objects**
7.	**Explain GPS and its working mechanisms.**
8.	**Compare three types of geodatabases**
9.	**Steps to connect Microsoft SQL Server from ArcGIS**
10.	**Illustrate Digitizers for Vector Data Input and Scanners for Raster Data Input.**
UNIT IV	**DATA QUALITYANDSTANDARDS** **9** Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards – Interoperability - OGC - Spatial Data Infrastructure
	UNIT IV/ PART-A
1.	**What is the role of meta data in GIS.** Metadata in GIS (Geographic Information Systems) plays a critical role in describing, organizing, and managing geospatial data. It provides essential information about the geographic datasets, helping users understand and effectively utilize the data. The role of metadata in GIS includes Data Description Data Discovery and Access Data Quality Assessment Data Management

2.	**What do you understand by precision?** Precision, in a general sense, refers to the level of exactness or refinement in a measurement, calculation, or description. It's about how closely repeated measurements or values agree with each other. In various fields like science, engineering, mathematics, and statistics, precision specifically refers to the consistency and reproducibility of results. It's distinct from accuracy, which relates to how close a measurement or value is to the true or intended value.
3.	**Define Meta data.** Metadata refers to data that provides information about other data. It offers details about various aspects of a particular dataset, document, file, or any information resource. Essentially, metadata describes the characteristics, context, content, and structure of the primary data, making it easier to manage, locate, retrieve, and use the actual data it represents.
4.	**What is meant by interoperability?** Interoperability refers to the ability of different systems, devices, or applications to connect, interact, and work together in a coordinated and effective manner, often despite differences in their structures, designs, or technologies. It is the capacity for diverse systems to exchange and use information seamlessly, often without requiring substantial modifications or interventions.
5.	**What is meant by tolerance error.** Tolerance error refers to the permissible limit or range within which a measurement, a manufactured part, or a system can deviate from its intended or specified value without affecting its overall performance or functionality. It represents the allowable variation or discrepancy that is acceptable before it is considered a problem or defect.
6.	**What are the two types of data accuracy?** Two types of accuracies i.e. positional and attribute accuracy **Positional Accuracy**: It means the accuracy of coordinate values that exists between digital and the real world. **Attribute Accuracy**: In simple terms, attribute accuracy basically deals with the attribute of the database in terms of precision related to characteristics of the map
7.	**Define data consistency.** Data consistency means the absence of discrepancy in a particular set of database. It also deals with the validity determination of a structure of dataset. This term is mainly used to indicate verification with firm topological rules with respect to geospatial data. Thus, the removal of topological discrepancies becomes a precondition and most of the geospatial databases are topologically cleaned prior to GIS processing.
8.	**What are the two types of data consistency?** Two types of consistencies: temporal and logical **Temporal Consistency**: This refers to the repetitive aspects of data handling processes. It includes data capture, storage, management, display, blend, output and analysis of data **Logical Consistency**: It means the reliability of relationship that exists amongst the real world and fixed geospatial data.
9.	**What is Data quality elements?** Data quality elements describe a certain aspect required for a dataset to be used and accurate. GIS data has different components to its quality. As defined by the International Organization for Standardization (ISO), these components include the following. • Completeness • Logical consistency • Spatial accuracy • Thematic accuracy • Temporal quality • Data usability

10.	**What is a thematic raster dataset?** It is a raster whose values represent a specific phenomenon or parameter. For example a Digital Elevation Model (DEM) is a thematic raster dataset. Each cell presents a pixel size in meters.
11.	**What is the digitizing process?** Converting geographic data either from a hard-copy or a scanned image into vector data by tracing the features.
12.	**What is spatial analysis?** The term *analysis* refers to data manipulation and data querying. In the context of **spatial analysis**, the *analysis* focuses on the *statistical analysis* of patterns and underlying processes or more generally, spatial analysis addresses the question "what could have been the genesis of the observed spatial pattern?" It's an **exploratory process** whereby we attempt to quantify the observed pattern then explore the processes that may have generated the pattern.
13.	**What is a Spatial Data Infrastructure (SDI)?** Spatial Data is the data or information that identifies the geographic location of features and boundaries on Earth and Space, such as natural or constructed features, oceans and space but also includes encoding attributes, observations and other metrics concerning these features and boundaries. Spatial data is usually stored as coordinates and topology, and is data that can be mapped. Spatial data is often accessed, manipulated or analyzed through Geographic Information Systems (GIS).
14.	**What is Data Lineage?** Data Lineage means the history or documentation of a geographic data set. Data lineage also deals with the developmental and compilation aspects. It consists of source, theme, capture requisites, geographic coverage and collection methods of the data
15.	**Define OGC.** OGC stands for the Open Geospatial Consortium. It is a global organization that works on developing open standards for geospatial and location-based information technologies. OGC focuses on creating and promoting standards for interoperability and sharing of geographic data, including mapping, location-based services, and various forms of spatial data. These standards help different systems and devices to communicate and share geospatial data effectively.
16.	**Define Data Governance.** Data Governance refers to the overall management of the availability, usability, integrity, and security of the data within an organization. It involves the orchestration of people, processes, policies, and technologies to ensure that data-related assets are managed effectively and in alignment with the organization's strategy and objectives. Key aspects of Data Governance include: Data Quality Data Security and Privacy Data Management Policies and Standards Data Stewardship Data Lifecycle Management Compliance and Regulation Decision-Making Support
17.	**What are the main components of SDI?** The main components following the general architecture of SDI are: • Spatial Data Management system to store, query and manage directly the data in the database. • A Catalogue system with a specific discovery service to harvest, search and query metadata and with integrated Metadata editor; • Network Service system based where data are distributed and elaborated via Web Service (mainly following OGC Standard); • A portal within a client to search, view, query and analyse the spatial data

18.	**Define positional accuracy.** Positional accuracy refers to the degree of closeness or precision with which a determined location or geographical position aligns with its actual or true position on the Earth's surface. It's a measure of how well a location is identified or represented in relation to its actual coordinates in the real world.
19.	**Define temporal accuracy.** Temporal accuracy refers to the precision and correctness of time-related information or events concerning their actual occurrence or sequencing in a given timeframe. It measures the degree of correctness in representing the timing of events, data, or processes.
20.	**Define completeness in GIS.** In Geographic Information Systems (GIS), completeness refers to the extent to which all necessary or expected information about a specific geographic area or dataset is present and available. It assesses whether the data includes all the elements, attributes, or features that are required for a particular analysis or purpose. Completeness in GIS can be evaluated based on different criteria: Attribute Completeness Feature Completeness Temporal Completeness
	UNIT-IV/PART-B
1.	**List out the several components of data quality and explain each one briefly.**
2.	**Explain briefly about the spatial data infrastructure.**
3.	**Write a short note on data quality standards in GIS**
4.	**Discuss about the various components of geospatial data quality.**
5.	**Discuss about the geospatial data standards.**
6.	**Critically review the need to built the spatial data infrastructure.**
7.	**Explain the various data quality issues arises in GIS project.**
8.	**Write a short note on data meta data in GIS.**
9.	**Explain the basic aspects in data quality and standards in GIS.**
10.	**Explain components of Spatial Data Infrastructure.**
UNIT V	**DATA MANAGEMENTANDOUTPUT** **9**
Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS- distributed GIS.	
	UNIT V/ PART-A
1.	**What is the reasons for importing and exporting spatial data?** By importing spatial data, you can obtain a great deal of spatial information that is already available in the industry. By exporting it, you can make it available in a standard file format to existing applications.
2.	**What are the fast growing job that uses GIS** ✓ Geographer ✓ Cartographer/Photogrammetrist. ✓ Urban /Regional Planner ✓ Surveyor
3.	**Show the maps convey the characteristics of features.** Maps are powerful tools for conveying the characteristics of various features. Here's how different types of maps can effectively depict specific features and their attributes: Topographic Maps Geological Maps Weather Maps Population Density Maps Ecological Maps

	Transportation Maps Land Use Maps
4.	**What is meant by skeletonising.** Skeletonization is a technique used in image processing and computer vision to reduce complex shapes or images into simpler, essential representations while preserving the structure or form. It's a process that converts a shape into its "skeleton," which typically consists of lines or curves that represent the essential structure or topology of the original shape.
5.	**In what way Distributed GIS is considered superior to desktop GIS.** Distributed Geographic Information Systems (GIS) and desktop GIS each have their own advantages and purposes, and one is not inherently superior to the other. However, distributed GIS has specific advantages over traditional desktop GIS in certain contexts: Collaboration and Data Sharing Scalability Accessibility and Flexibility Real-Time Updates Redundancy and Reliability Processing Power Geographically Dispersed Data Management
6.	**What is File Geodatabase?** **File geodatabase** is a relational database storage format. It's a far more complex data structure than the shapefile and consists of a **.gdb** folder housing dozens of files. Its complexity renders it more versatile allowing it to store multiple feature classes and enabling topological definitions (i.e. allowing the user to define rules that govern the way different feature classes relate to one another).
7.	**How GIS is helpful for environmental monitoring?** GIS in natural resource management provides a graphical data that helps in monitoring the environment. It determines the qualitative and quantitative data about the environment issues such as pollution, land degradation, soil erosions etc. GIS in natural resource management detects these problems and predicts the future hazards. Thus, GIS in natural resource management monitors all these environment problems.
8.	**Define Navigation mapping** Navigation mapping assists the navigation content providers using GIS, GPS, and Remote sensing technologies instead of traditional method of manual assimilation of data for generation of navigation content. The rampant increase in the number of people who use computerised navigational services for everyday use.
9.	**How GIS helps in navigation?** GIS has been utilized in sailing and other small craft to help navigate not just the location of other vessels but also land features and obstacles that may arise or even cause danger to boats. Safety, therefore, is often of critical importance, particularly as objects that can cause hazards are constantly changing (e.g., positioning of other boats). In early forms of GIS used for small ships, adaptive GIS processes were critical aspects requiring not only the use of GPS data but other signals as well, including transmitters used for traditional signaling. The signal and geographical contexts are the two critical datasets needed in this approach. Combining contexts and different possibilities between the presence and absence of data within these contexts allow a simple adaptive process for navigation (e.g., another ship emitting a signal that provides a location context). If data are found within the context, then the application can update and provide a view, while data outside the contexts (i.e., no signal) are left without updates or could be interpolated based on known last transmission.
10.	**What is the difference between GIS and GPS** GPS stands for Global Positioning System. GPS uses satellites that orbit Earth to send information to GPS receivers that are on the ground. The information helps people determine their location.

	GIS is a software program that helps people use the information that is collected from the GPS satellites.
11.	**What is vehicle tracking system?** A **vehicle tracking system** is an electronic device installed in a vehicle to enable the owner or a third party to track the vehicle's location. Most modern vehicle tracking systems use Global Positioning System (GPS) modules for accurate location of the vehicle. several types of Vehicle Tracking devices exist. Typically they are classified as "Passive" and "Active". Passive" devices store GPS location, speed, heading and sometimes a trigger event such as key on/off, door open/closed. Once the vehicle returns to a predetermined point, the device is removed and the data downloaded to a computer for evaluation. Passive systems include auto download type that transfer data via wireless download. "Active" devices also collect the same information but usually transmit the data in real-time via cellular or satellite networks to a computer or data center for evaluation.
12.	**List the uses of vehicle tracking system.** Stolen Vehicle Recovery, Fleet Management, Asset Tracking, Field Service Management, Trailer Tracking, Law enforcement or surveillance, Transit Tracking, Homeland Security
13.	**Show a typical format of compiled map.** A compiled map is usually presented in a standardized format that includes various elements to convey geographic information. Here's an outline of a typical format for a compiled map Title and Legend Scale Bar North Arrow or Orientation Indicator Data Source and Date Map Body Inset Maps or Locator Maps Notes or Annotations Grid Lines or Coordinates Credits
14.	**What do you meant by vectorisation.** Vectorization, in the context of digital imagery or graphics, refers to the process of converting raster (bitmap) images or information into vector graphics. This transformation involves recreating the image or information using mathematical descriptions of geometric shapes, such as points, lines, curves, and polygons, rather than pixels. Here are the key aspects of vectorization: Vector Graphics Raster to Vector Conversion Object Recognition and Tracing Simplification and Precision Applications Software and Techniques
15.	**List out the types output in GIS.** In Geographic Information Systems (GIS), there are various types of outputs that serve different purposes and aid in conveying geographical data and analyses. Here are several common types of outputs in GIS. Maps Static Maps Charts and Graphs 3D Visualizations Tabular Reports Geospatial Analysis Results

	Georeferenced Images Geodatabases and Data Files Structured Databases Decision Support Systems GIS Applications and Web Services Custom Outputs
16.	**How is GIS used in marketing?** GIS database marketing allows you to integrate demographic, geographic, purchasing, and spending characteristics into models that will accurately segment your customers.
17.	**List few softwares to perform direct marketing analysis.** • ArcGIS Business Analyst • ESRI BIS data • ArcIMS • Community Tapestry • Community Coder • Business Analyst Online
18.	**What is the use of ArcGIS software?** Direct marketers can use ArcGIS software to create, manage, integrate, analyze, display, and disseminate data about their customers and prospects. Multiple GIS extensions allow you to choose from a variety of software options to customize your ArcGIS applications.
19.	**What is the use of ArcIMS software?** ArcIMS software is the foundation for distributing GIS data and applications on the Internet. By providing a common platform for exchanging and sharing GIS resources, ArcIMS provides unique opportunities to leverage data from within the organization and to integrate information from other agencies.
20.	**Expand OGC.** OGC stands for the Open Geospatial Consortium. It is a global non-profit organization that develops and publishes standards for geospatial and location-based technologies. The primary goal of the OGC is to promote interoperability and the use of geospatial data and services across different platforms, systems, and applications.
	UNIT V/ PART-B
1.	**Explain Enterprise GIS in detail.**
2.	**Discuss in details about the various forms of GIS output.**
3.	**Explain in detail about converting vector data in to raster data structure.**
4.	**Explain GIS in Navigation industry**
5.	**Discuss about the typical data warehouse architecture used in enterprise GIS**
6.	**Elaborate on vehicle tracking system process?**
7.	**Explain in detail about the multimedia information products.**
8.	**Describe the Enterprise GIS and Distributed GIS with their own advantages and limitations.**
9.	**Describe the map compilation process in GIS.**
10.	**Design the map layout and explain the components.**