**DESIGN AND IMPLEMENTATION OF GEOSPATIAL INFORMATION SYSTEMS**

**GE 702**

Lecture: 3 Hrs Years: IV

Practical: 3 Hrs Part: I

Course Objective

The topic covered in this subject will include: the fundamentals of non-spatial and spatial database; spatial data modeling including entity- relationship models; query language and query processing. On successful completion of this subject student will be able to:

1. Describe basic concept of designing geospatial information systems
2. Describe the need for spatial database, and the difference between spatial and non-spatial database systems.
3. Describe the design and principle of spatial databases, including techniques for efficiently storing and retrieving spatial data.
4. Design queries for spatial and non-spatial database systems.
5. Use and customize specific spatial and non- spatial database system

Course content:

1. Introduction to DBMS: 4 Hrs
   1. General overview of DBMs, Terms and Terminologies.
   2. Application of DBMS: Where and how it is used, Comparison with other data technologies.
   3. Database technology for geospatial data, Basic characteristics of a DBMS.
   4. Components of DBMS, function of DBMS, interaction with DBMS
2. Data Models, database languages: 5 Hrs
   1. Introduction to data models
   2. Basics of ER model, relational model and other models
   3. Database Language types, constraints, keys, design issues,
   4. Entity-relationship diagram, weak entity sets
3. Relational data model: 4 Hrs
   1. Terminologies, need of relational data model,
   2. Relational database, constraints, keys
4. SQL: 6 Hrs
   1. Background, Basic structure,
   2. Set operation, aggregate functions, null values,
   3. Nested sub queries, views,
   4. Modification of database, joined relationship,
   5. Data-definition Language
5. Spatial database technology: 4 Hrs
   1. Introduction, differences with tradition (non-spatial) DBMS, values of SDBMS, user
   2. Basic of spatial taxonomy and data models
   3. Concept on spatial query language, standards, data mining
6. Spatial concepts and data models: 5 Hrs
   1. Models of spatial information: field based model, object-based models
   2. Spatial data types
   3. Operation on spatial objects: set oriented, topologies, directional, metric space, Euclidean
   4. ER model with spatial nation: extending ER model with pictogram
   5. Object oriented data modeling with UML, comparison between ER and UML
7. Spatial query language: 8 Hrs
   1. SQL for Spatial databases, OGIS standard for extending SQL
   2. Object- relational SQL, object-relationship schema
8. Computational geometry: 4 Hrs
   1. Basic concept of algorithms, algorithm analysis, optimality, data structure
   2. Useful algorithm strategies
   3. Algorithm for spatial databases
9. Spatial storage and access methods: 5 Hrs
   1. Storage; Disks and Files
   2. Disk geometry and implication
   3. Buffer Manager
   4. Filed, Record, and File
   5. File Structures
   6. Clustering
   7. Spatial Indexing
   8. Grid Files
   9. R-Trees
   10. Cost Models

Practical:

1. Retrieving data from a relational database 6 Hrs
2. Building a Postgres / PostGIS database 6 Hrs
3. Working with PostGIS spatial functions 9 Hrs
4. Spatial query exercise in Postgres and PostGIS 15 Hrs
5. Using PostGIS in web application and desktop application 9 Hrs

Reference:

1. Shashi Sgekher, Sanjay Chawla (2003), Spatial Databasea a tour.
2. Philippe Rigaux. Michel Scholl, Anges Voisard (2002), Spatial Databases with Application to GIS. Morgan Kaufmann Publishers
3. Raghu Ramakrishna, Johannes Gehrke (2007), Database Management System/McGraw-Hill Education.
4. Abraham Siberschatz, Henry Korth, S.Sudaeshan (2010), Database system concepts,McGraw-Hill Education.
5. Database system concepts by silberschatz, korth and Sudarshan
6. Database management system by Ram krishna Gehrke
7. Different Publications

Assessment: Averaging of three Evaluation Scheme:

The question will cover all the chapters in the syllabus. The evaluation scheme will be as mentioned in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
| S. No. | Chapter | Hours | marks allocation\* |
| 1 | 1,2 | 9 | 16 |
| 2 | 3,4 | 10 | 16 |
| 3 | 5,6 | 9 | 16 |
| 4 | 7 | 8 | 16 |
| 5 | 8, 9 | 9 | 16 |
|  | Total | 45 | 80 |

\* There may be minor variation in marks distribution.