SECOND SEMESTER

1. DGI 201 Spatial Database, Analysis and Modeling and Satellite Image Processing – (3-0)

Introduction to Database System: Definition, purpose, data abstraction, instances, schema, DDL, DML, database manager, database administrator, and basic concepts of entity, relationship and primary key.

Introductory concepts, Basic components of computers, Hardware, Software requirements for GIS Processors, Internet, Operating Systems, Programming languages

GIS and Remote Sensing data, Formats & exchange etc: Image storage formats, Data retrieval & Data compression techniques

Data Structures: Geographical data; spatial & non spatial, geographical data in computers, Data Models: Spatial data Model – (i) Cartographic Map model – Raster structure, Quad tree Tessellation (ii) Geo-relational Model – Vector Data structure, Advantages & Disadvantages of Both

Data base structure: Non spatial: Hierarchical structure, Network structure, Relational Structure, Spatial Data Bases: Hybrid Data Model, Integrated Data Model

Data Quality and Errors in GIS: Nature of geographic data – types of uncertainty in a GIS, Sources of Errors in GIS data base: Obvious sources from natural variations & original measurements, Errors through processing, errors associated with overlaying of polygons, Data Quality parameters: Positional accuracy, Attribute accuracy, Logical consistency, Completeness Lineage

Handling Errors in GIS, Normalization in GIS, Levels of Measurements: Nominal, Ordinal, Ratio and Interval, Advantages of RDBMS over DBMS

SIP

Concepts about digital image and its characteristics, Spectral, Spatial, Radiometric and Temporal resolution, Visual vs. Digital methods, Image data storage and retrieval, Types of image displays and FCC

System design considerations, Sources of image degradation – Pre-processing of satellite image, Radiometric and Geometric correction technique, Interpolation methods – linear and nor linear transformation for geometric corrections

Look-up Tables (LUT) and Image display, radiometric enhancement techniques, Spatial enhancement techniques, Contrast stretching: Linear and non-linear methods

Low Pass Filtering: Image smoothing, High Pass Filtering: Edge enhancement and Edge detection, Gradient filters , Directional and non-directional filtering

Band ratio, Types of Vegetation indices, Principal Component Analysis, Multi dated data analysis and Change detection

Basics of Pattern Recognition, Spectral discrimination, Signature bank, Parametric and Non-Parametric classifiers, Unsupervised classification methods, Supervised classification techniques, Limitations of standard classifiers

TEXT BOOKS:

1. Goodchild, M.F. (1978) - Statistical Aspects of the Polygon Overlay Problems, in Harvard papers on GIS, Ed. G. Dulton, Vol. 6, Addison Wesley and Reading Press.
2. Mary Summer, Computers: Concepts and Uses, Prentice Hall, Englewood Cliffs. New Jersey.
3. Mac Donald, A. 1999, Building a Geodatabase, Redlands CA: ESRI Press.
4. Sabins, Floyd F., Remote Sensing: Principles and Interpretation, H. Freeman and C., New York.
5. Thomas M. Lillesand & Kiefer, Ralph W., Remote Sensing and Image Interpretation, John Wiley & Sons, New York.
6. Jensen, JR., Remote Sensing of the Environment – An Earth Resources Perspective, Prentice Hall Inc.

REFERENCE BOOKS:

1. Sanghavi, Hitesh (1998) Oracle Miracles, Express computers methods, 1998.
2. Bonham Carter G.F (1994) GIS for Geoscientists: Modeling with GIS Pergamon Publications.
3. Samet, H. 1990, The Design and Analysis of Spatial Data Structures, Addison–Wesley.
4. A. Silberschats, Henry F. Korth "Database System Concepts", 3rd Edition, TMH, 1998
5.Rencz, Andrew N. (Ed), Remote Sensing for the Earth Sciences: Manual of Remote Sensing, 3rd ed., John Wiley & Sons, Inc., New York.
6.Curran, P., Principles of Remote Sensing, Longman, London.
1. Campbell, James B., Introductory Remote Sensing: Principles and Concepts, Routledge.
2. Gibson, P.J., Introduction to Remote Sensing, 2nd ed., Taylor & Francis, London.

Cracknell, A.P. & Hayes, L.W B., Introduction to Remote Sensing, Taylor & Francis, London.

DGI 202 A Applications of Geoinformatics – (3-0)

Emergence of geoinformatics technology in application areas, understanding potentials of geoinformatics in allied sectors, geoinformatics advantage over conventional techniques. Indian satellite missions with focused applications, Recent trends in geoinformatics applications.

Application in Land Resource: Remote sensing in mapping soil degradation, impact of surface mining on land resources, forest resources.

Application in Water Resources: Remote sensing in hydro-geomorphological interpretation for groundwater exploration, water quality monitoring, reservoir sedimentation, snow cover mapping and modeling approaches.

Application in Disaster Management: Mapping and modeling Landslide hazards, floods, Cyclones Forest fire and drought.

Application in Urban Planning: Mapping urban landuse, transportation network, Utility-Facility mapping, urban sprawl, site selection for urban development, Urban Information System

Application in Geo-technical Engineering: Slope stability and drainage network analysis, Digital Terrain Modeling, Geoinformatics in Dam site selection, Highways, and Tunnel Alignment studies.

Application in Environmental Management: Selection of disposal sites for industrial and municipal wastes, solid waste management, Environmental Impact Assessment (EIA)

TEXT BOOKS:

1. Schultz, G. A. and Engman, E. T. 2000. Remote Sensing in Hydrology and Water Management, Springer-Verlag, Berlin, Germany.
2. Lillisand, T. M. and Keifer, R. W. 1994. Remote Sensing and Image interpretation', John Willey and Sons, New York, Third Edition
3. Jenson, J.R. 2000. Remote Sensing of the environment – An Earth Resource Perspective, Prentice Hall Inc.
4. P.S. Roy (2000). Natural Disaster and their mitigation. Published by Indian Institute of Remote Sensing (IIRS), 2000.

REFERENCE BOOK:

1. Spatial Technologies for Natural Hazard Management. Proceedings of ISRS National Symposium, Nov. 21-22, 2000, IIT, Kanpur

DGI 202B Geoinformatics in Disaster Management – (3-0)

Fundamental concepts of hazards and disasters, their types, and characterization, zonation of hazards, natural and human induced disasters. Disaster and National losses, historical perspective of disasters in India.

Geological Hazards: Landslide, Earthquake, Mining hazards (subsidence, flooding etc.), Volcanic hazards, Groundwater hazards, Glacial hazards

Hydro meteorological Hazards: Flash floods, River floods, Dam burst, Cloud burst, Cyclones, Coastal hazards and Drought

Environmental hazards: Forest hazards (Deforestation, Degradation and Forest fire), Land, soil degradation, desertification and Pollution (Water, air and soil)

Disaster Management: Fundamental concept of Disaster Management, government, NGOs and peoples participation disaster management. Existing organization structure for managing disasters in India. Geoinformatics in disaster mitigation.

TEXT BOOKS

P.S. Roy (2000). Natural Disaster and their mitigation. Published by Indian Institute of Remote Sensing (IIRS), 2000.

REFERENCE BOOKS

Spatial Technologies for Natural Hazard Management. Proceedings of ISRS National Symposium, Nov. 21-22, 2000, IIT, Kharagpur.

DGI 202C Applications if Geoinformatics in Engineering Projects (3-0)

Best Practices and use cases on Applications of Geoinformatics in Engineering projects like Smart Cities, Water supply management, Telecommunications, Electricity and other facility management.

DGI 202DGeoinformatics in Water Resources Management – (3-0)

Hydrologic Cycle, hydrological parameters, porosity, permeability, specific yield, Types of aquifers.

Watershed Management: Watershed characterization, delineation and codification, watershed problems and management strategy. Geoinformatics approach for watershed prioritization

Remote Sensing in Surface - Subsurface Water Exploration: Application of remote sensing in hydro-geomorphological interpretation for ground water exploration, water quality monitoring through remote sensing.

Water Conservation Projects: Geoinformatics based site selection for river valley projects, surface water harvesting structures: check dam, Nala bunds, subsurface dykes etc.

Operational Applications in Water Resources: Flood prediction, drought evaluation, snow cover mapping, reservoir sedimentation evaluation.

Geoinformatics Models in Water Resources: Geoinformatics based Runoff and hydrological modeling, flood Hazards modeling, snowmelt runoff modeling.

Case Studies: Hydro-geomorphological mapping in Plateau region, Flood prone zone mapping in Indo-Gangetic Plains, Water harvesting initiatives in urban built up lands.

TEXT BOOKS

1. Schultz, G. A. and Engman, E. T. 2000. Remote Sensing in Hydrology and Water Management, Springer-Verlag, Berlin, Germany.
2. Murthy, J. V. S. 1994. Watershed Management in India. Wiley Eastern Ltd., New Delhi.
3. Todd David Keith. 1980. Groundwater Hydrology, John Wiley & Sons, New York, Second Edition.
4. Schultz, G.A. & Engman, E.T., 2000. Remote Sensing in hydrology and water management, Springer-Verlang, Berlin, Germany.

REFERENCE BOOKS

1. Dutta, D., Sharma, J.R. and Adiga, S. (2002). Watershed characterization, development planning, and monitoring- Remote sensing approaches, Tech. Report, ISRO-NNRMS-TR-103-2002.
2. Manual of Remote Sensing, vol-II, Chapter on “Water Resources Assesment”. American Society of Photogrammtery.

DGI 291 Database Analysis Lab (0-2)

1. Concept of entity and relationship.
2. Creation of Tables
3. Concept of SQL
4. Performing various actions over table
5. Merging of tables by using primary key
6. Maintaining database

Satellite Image Processing

1. Introduction to ERDAS IMAGINE Study of the marginal information given on the C.D. Rom/Digital data
2. Import / Export of files using ERDAS IMAGINE Geo-reference of the toposheet and imageries
3. Display, Analysis and interpretation of black & white images and FCC
4. Study of various contrast enhancement techniques
5. Low Pass Filter: Compression of the high frequency component & enhancement of the low frequency component
6. High Pass Filter: Compression of the low frequency component and enhancement of the high frequency component
7. Sub-setting of area of interest from the satellite image
8. Principal Component Analysis
9. Resolution Merging
10. Unsupervised Classification
11. Supervised Classification
12. Map composition

DGI 292A. Application in Geo-informatics Lab (0-2)

DGI 292B Disaster Management Lab – (0-2)

1. Flood prone area mapping using satellite images and ancillary data.
2. Forest fire risk mapping using satellite images and GIS.
3. Landslide mapping and risk evaluation.
4. Multivariate analysis and application of geoinformatics model for landslide hazard zonation
5. Drought prone area mapping using satellite images
6. Spatial variation of climatic data using GIS techniques for drought prediction
7. Terrain mapping in coastal region for coastal hazards prediction
8. Multiple hazard mapping using satellite images and modeling risk in GIS.

DGI 292C. Applications of Geoinformatics in Engineering Projects – (0-2)

1. Satellite image based hydro-geomorphological interpretation for ground water targeting. Open cast mining impacts on land resources using satellite images.
2. Mapping flood hazards in a region using satellite images
3. Mapping landslide hazards in a region using satellite images
4. Urban sprawl mapping of a township using satellite images
5. Utility-facility mapping for regional development analysis in GIS
6. Application of Geoinformatics for identification of waste disposal sites.
7. Digital terrain models for selection of dam site and road infrastructure.

DGI 292D. A Water resources Management Lab – (0-2)

1. Delineation of river catchments on satellite image- topographical sheets and their codification as per Watershed Atlas of India.
2. Evaluation of various drainage morphometric parameters for watershed characterization.
3. Hydro-geomorphological mapping for ground water exploration in alluvial terrain.
4. Hydro-geomorphological mapping for ground water exploration in hard rock terrain
5. Flood inundation mapping in alluvial plain areas using satellite images

6. Locating surface water harvesting structures like check dams, de-siltation tanks, and
7. nullah bunds etc. using satellite image
8. Location of high dams and tunnels in hard rock terrain for large irrigation projects
9. Creation of flow direction, flow length, flow accumulation in a watershed based on
10. contours using Arc-View GIS
11. Study of snow covered areas for evaluation of its water resources using satellite images.
12. Rainfall run-off modeling using geoinformatics approach.