Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester III

Credit 4

Paper-12

(Special Paper)

Remote Sensing and GIS Applications in Environmental Management - I

Unit 1:

Environmental Management -Tools and Techniques

Satellite Remote Sensing and GIS for environmental management – concepts and applications

Purpose and Benefits of GIS in environmental management, Functional Elements of environmental GIS, Importance of Remote Sensing Data in environmental GIS

Unit 2:

Geospatial technologies and techniques for environmental mapping with GIS

Sources of data for environmental GIS, Relating environmental information from different sources, Data representation, Data capture

Unit 3:

Rasterization and vectorization, Projection and coordinate system

Spatial analysis with GIS, Data output, GIS data mining

Unit 4:

Establishing GIS database for environmental management

Change detection, Participatory GIS, Environmental Remote Sensing

GIS modeling for environmental application

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester IV

Credit 4

Paper-16

(Special Paper)

Remote Sensing and GIS Applications in Environmental Management - II

Unit 1:

Digital mapping: Concept, map elements, layers, scales, and representation
Map prohection: Coordinate system and projection systems
Data structure: Raster Data Structure, Vector Data Structure, Data Compression Techniques
Data acquisition: Analogue to digital conversion, Data from Remote Sensing Imagery, Global Positioning System (GPS) based data acquisition

Unit 2:

Data Manipulation and Analysis: Data Manipulation Techniques, Spatial Analysis Techniques –statistical and geometrical, Geoprocessing Techniques, Model Development
Spatial Accuracy Assessment: Data Quality, Accuracy Assessment using Statistical Tests
Open GIS: Introduction of Open Concept in GIS, Open Source Software for Spatial Data Analysis
Map Design: Layout of Maps, Intelligent Maps, Charting and Tabular representation of the results using GIS

Unit 3

GIS for decision support in environmental management, Vegetation Mapping and Monitoring,
Applications of Remote Sensing and GIS in Wildlife Mapping and Modeling,
Biodiversity Mapping and Modeling
Approaches to Spatially Distributed Hydrological Modeling in a GIS Environment
Remote Sensing and GIS for Natural Disaster Management
Land Use Planning and Environmental Impact Assessment Using GIS

Unit4

GIS in Environmental modeling : Hydrological modeling, Atmospheric modeling,
Landsurface-subsurface modeling, Biological/ecological modeling,
Disaster management and risk modeling. Infrastructure development planning
Urban environmental management

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester III

Credit 4

Paper-12

(Special Paper)

Remote Sensing and GIS Applications in Environmental Management - I

Unit 1:

Environmental Management -Tools and Techniques

Satellite Remote Sensing and GIS for environmental management – concepts and applications

Purpose and Benefits of GIS in environmental management, Functional Elements of environmental GIS, Importance of Remote Sensing Data in environmental GIS

Unit 2:

Geospatial technologies and techniques for environmental mapping with GIS

Sources of data for environmental GIS, Relating environmental information from different sources, Data representation, Data capture

Unit 3:

Rasterization and vectorization, Projection and coordinate system

Spatial analysis with GIS, Data output, GIS data mining

Unit 4:

Establishing GIS database for environmental management

Change detection, Participatory GIS, Environmental Remote Sensing

GIS modeling for environmental application

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester IV

Credit 4

Paper-16

(Special Paper)

Remote Sensing and GIS Applications in Environmental Management - II

Unit 1:

Digital mapping: Concept, map elements, layers, scales, and representation
Map prohection: Coordinate system and projection systems
Data structure: Raster Data Structure, Vector Data Structure, Data Compression Techniques
Data acquisition: Analogue to digital conversion, Data from Remote Sensing Imagery, Global Positioning System (GPS) based data acquisition

Unit 2:

Data Manipulation and Analysis: Data Manipulation Techniques, Spatial Analysis Techniques –statistical and geometrical, Geoprocessing Techniques, Model Development
Spatial Accuracy Assessment: Data Quality, Accuracy Assessment using Statistical Tests
Open GIS: Introduction of Open Concept in GIS, Open Source Software for Spatial Data Analysis
Map Design: Layout of Maps, Intelligent Maps, Charting and Tabular representation of the results using GIS

Unit 3

GIS for decision support in environmental management, Vegetation Mapping and Monitoring,
Applications of Remote Sensing and GIS in Wildlife Mapping and Modeling,
Biodiversity Mapping and Modeling
Approaches to Spatially Distributed Hydrological Modeling in a GIS Environment
Remote Sensing and GIS for Natural Disaster Management
Land Use Planning and Environmental Impact Assessment Using GIS

Unit4

GIS in Environmental modeling : Hydrological modeling, Atmospheric modeling,
Landsurface-subsurface modeling, Biological/ecological modeling,
Disaster management and risk modeling. Infrastructure development planning
Urban environmental management

Interdisciplinary Department of Remote Sensing and GIS Applications

***M.Sc. (Remote Sensing & GIS Applications*)**

Session 2015-16

Semester III Credit 4

Paper-10

Cartography, Mapping and GIS Techniques

Unit I:

Cartography – meaning and scope, historical development, Maps – its types; concept of scale and its function; Representing earth – map projections and its function.

Unit II:

Map as an interface – representing geography – point, line, area features. physical features, terrain, weather and climatic data; socio – economic data – qualitative and quantitative data.

Unit III:

Maps and the nature of GIS applications; vector and raster data characteristics; data classification and analysis. Working with digital data.

Unit IV:

Data analysis – measurements, queries, reclassification, buffering, data integration. Modelling human processes, GIS project design and management.

Suggested Books:

1. Fundamentals of GIS by Micheal Demers
2. Remote Sensing and Geographic Information System by Anji Reddy
3. Remote Sensing and Geographic Information System by A.M. Chandra
4. Concepts and Techniques of Geographic Information System by Lo and Yeung.
5. www.GISdevelopment.net

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester III

Credit 4

Paper-12

(Special Paper)

Remote Sensing and GIS Applications in Geosciences-I

Unit-I

Concepts and techniques of lithological mapping. Application of remote sensing in identification, delineation and characteristics of common rock types: sandstone, shale, limestone, granite, quartzite, basalt etc. Case studies and examples from India.

Unit-II

Concept and technique of Structural mapping. Application of remote sensing in identification, delineation and characteristics of lineaments, joints, fractures, faults, folds etc. Importance of structural features in site selection of engineering structures: dams, tunnels, reservoirs etc. Case studies and examples from India.

Unit-III

Geomorphological mapping of the landforms. Identification, delineation and characteristics of fluvial, eolian and glacial landforms on remotely sensed data. Major geomorphic features of important geological regions of India and their characteristics.

Unit IV

Drainage characteristics and slope analysis using remote sensing and GIS. Morphometric analysis of drainage basins-linear, shape and areal parameters. DEM and its applications in geological studies. Slope suitability analysis for geological structures.

Suggested Books:

1. Remote Sensing-Principles and Interpretation by Sabins.
2. Remote Sensing and image interpretation by Lillesand and Keifer
3. Fundamentals of Remote Sensing by George Joseph
4. Remote Sensing of Environment by A.R. Jensen
5. Remote Sensing and Geographical Information System by Anji Reddy
6. Principal of Remote Sensing by P.J. Curran
7. Campbell, J.B.2002: Introduction to Remote sensing. Taylor Publications
8. Drury, S.A., 1987: Image Interpretation in Geology. Allen and Unwin
9. Gupta, R.P.., 1990: Remote Sensing Geology. Springer Verlag

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester IV

Credit 4

Paper-16

(Special Paper)

Remote Sensing and GIS Applications in Geosciences-II

Unit-I

Distribution of Coal fields in India. Application of remote sensing and GIS in coal mining and exploration. Active and abandoned mines-impacts on the local environment. Case studies and examples from India

Unit-II

Oil and gas reserves in India. Terrain parameters and role of remote sensing in Oil and gas exploration. Integration of geological, geophysical and field data for oil and gas exploration.

Unit-III

Major and prominent mineral/ore deposits of Iron, manganese, copper, lead and zinc, aluminium and uranium. Application of remote sensing and GIS in mineral prospecting and exploration. Case studies and examples from India.

Unit VI

Digital image processing techniques in geological studies- lithological, structural, and landform analysis. Integration of remote sensing, field data and attribute data in GIS. Case studies and examples from India.

Suggested Books:

1. Remote Sensing-Principles and Interpretation by Sabins.
2. Remote Sensing and image interpretation by Lillesand and Keifer
3. Fundamentals of Remote Sensing by George Joseph
4. Remote Sensing of Environment by A.R. Jensen
5. Remote Sensing and Geographical Information System by Anji Reddy
6. Principal of Remote Sensing by P.J. Curran
7. Campbell, J.B.2002: Introduction to Remote sensing. Taylor Publications
8. Drury, S.A., 1987: Image Interpretation in Geology. Allen and Unwin
9. Gupta, R.P.., 1990: Remote Sensing Geology. Springer Verlag

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester III

(Special Paper)

Paper-12

Remote Sensing and GIS Applications in Water Resources-I

Unit-I

Components of hydrologic cycle and Global water resources. Major Indian river basins- surface and groundwater resource potential. Basic Concepts of a river basin, watershed, catchment. Terrain Parameters of watersheds and their role in water resources.

Unit-II

Spectral characteristics of water, snow and surface water inventory. OCM application in water. Snow horology, snow melt run-off and glacial inventory. Application of remote sensing in laying of canals, construction of reservoirs. Case studies and examples from India.

Unit-III

Types of drainage and Watershed characteristics. morphometric analysis of watersheds: linear, shape, relief and areal parameters. DEM and slope analysis. Application of remote sensing in Watershed characterisation and prioritization based on Morphometric parameters. Case studies and examples from India.

Unit-IV

Groundwater provinces of India: characteristics, status, problems and challenges. Status of groundwater development in various states: critical, dark and overexploited blocks/districts. Groundwater exploration in consolidated terrain-hard rocks and unconsolidated terrain-alluvial terrain Hydrogeomorphic mapping for delineation of groundwater potential zones in different terrains using remote sensing and GIS**.** Case studies and examples from India.

BOOKS RECOMMENDED:

Anji Reddy, M. 2004 : Geoinformatics for environmental management. B.S. Publications
Chow, V.T., 1988: Advances in Hydro science McGraw Hill
Drury, S.A., 1987: Image Interpretation in Geology. Allen and Unwin
Gupta, R.P.., 1990: Remote Sensing Geology. Springer Verlag.
Jensen,J.R. 2000 : Remote Sensing of the Environment: An Earth resource Perspective. Prentice Hall
Karanth, K.R., 1987: Groundwater Assessment-Development and Management. Tata McGraw Hill.
Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation, John Wiley.
Paine, D.P.,1981: Aerial Photography and Image Interpretation for Resource Management. John Wiley.
Sabbins, F.F., 1985: Remote sensing Principles and interpretation. W.H.Freeman and company
Todd, D.K., 1980: Groundwater Hydrology. John Wiley
Rajora, R., 2003: Integrated Watershed Management. Rawat Publication

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester IV

(Special paper)

Paper-16

Remote Sensing and GIS Applications in Water Resources-II

Unit-I

Surface water resources and Rainfall run off relationship. Mapping and assessment of surface water resources using satellite data.. Location and site selection of water harvesting structures (check dams, percolation ponds, nala bunds etc.) in basins using remote sensing and GIS. Case studies and examples from India.

Unit-II

Strategies for watershed management. Watershed management practices. Application of remote sensing and GIS in assessing health of watersheds. Application of remote sensing and GIS in water logged areas. Case studies and examples from India.

Unit-III

Shrinkage of reservoirs and sediment yield using temporal satellite data Sediment yield index- role of remote sensing and GIS. Case studies and examples. Remote sensing applications in river valley projects.

Unit-IV

Application of remote sensing in drought monitoring and assessment- hydrological drought, agricultural drought and meteorological drought. CAPE and CADA missions of Indian government.

BOOKS RECOMMENDED:

Anji Reddy, M. 2004 : Geoinformatics for environmental management. B.S. Publications
Chow, V.T., 1988: Advances in Hydro science McGraw Hill
Drury, S.A., 1987: Image Interpretation in Geology. Allen and Unwin
Gupta, R.P.., 1990: Remote Sensing Geology. Springer Verlag.
Jensen,J.R. 2000 : Remote Sensing of the Environment: An Earth resource Perspective. Prentice Hall
Karanth, K.R., 1987: Groundwater Assessment-Development and Management. Tata McGraw Hill.
Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation, John Wiley.
Miller, V.C., 1961: Photogeology. McGraw Hill.
Paine, D.P.,1981: Aerial Photography and Image Interpretation for Resource Management. John Wiley.
Pandey, S.N.,1987: Principles and Applications of Photogeology. Wiley Eastern,.
Sabbins, F.F., 1985: Remote sensing Principles and interpretation. W.H.Freeman and company
Todd, D.K., 1980: Groundwater Hydrology. John Wiley
Rajora, R., 2003: Integrated Watershed Management. Rawat Publication

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester IV

Session 2015-16

Credit 4

Paper-13

Application of Remote Sensing in Natural Resources

Unit-I

Types of natural resources: renewable and non-renewable. Renewable: wind, solar, water, forest, soil, Non-renewable: minerals, oil and gas, coal. Status of natural resources in India. Case studies and examples.

Unit-II

Soil classification, Soil types and Spectral signatures. Major soil types of India. Factors affecting Soil erosion, degradation and fertility. Application of remote sensing in soil type mapping, erosion assessment and degradation. forests, water. Degradation of natural resources (soil, forest, coal, water, minerals etc.) with specific reference to India. Causes and remedial measures in natural resources degradation. Government policies vis-a-vis natural resources. Case studies and examples from India.

Unit-III

Water resources depletion in India. Causes of water resources depletion. Application of remote sensing and GIS in monitoring and degradation of surface water resources. Spectral signatures of water and mapping water quality. Case studies and examples from India.

Unit IV

Forest resources of India. Degraded and non-degraded forest. Identification of forest categories on satellite data. Coal fields in India. Application of remote sensing in coal exploration-monitoring land and water degradation resulting from expansion of coalfields. Case studies and examples from India.

BOOKS RECOMMENDED:

Anji Reddy, M. 2004 : Geoinformatics for environmental management. B.S. Publications
Drury, S.A., 1987: Image Interpretation in Geology. Allen and Unwin
Gupta, R.P.., 1990: Remote Sensing Geology. Springer Verlag.
Jensen,J.R. 2000 : Remote Sensing of the Environment: An Earth resource Perspective. Prentice Hall
Karanth, K.R., 1987: Groundwater Assessment-Development and Management. Tata McGraw Hill.
Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation, John Wiley.
Paine, D.P.,1981: Aerial Photography and Image Interpretation for Resource Management. John Wiley.
Sabbins, F.F., 1985: Remote sensing Principles and interpretation. W.H.Freeman and company
Todd, D.K., 1980: Groundwater Hydrology. John Wiley
Rajora, R., 2003: Integrated Watershed Management. Rawat Publication

Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session: 2015-2016

Semester-II

Contact hours: 28 (including tutorials)
Credits 2

Paper-14

Hyperspectral Remote Sensing

UNIT I

History and description of hyperspectral imaging; Spectral radiometry: Principles - Radiance Vs Reflectance; Solar Irradiance and Atmospheric Path Radiance; Theory of Atmospheric Correction, Imaging Spectrometers: Operational Considerations; Hyperspectral Remote Sensing and the Atmosphere.

UNIT II

Atmospheric Interactions; Amount of Atmospheric Reflection; Amount of Atmospheric Absorption, Amount of Atmospheric Scattering, Atmospheric Transmission; Hyperspectral sensors; Hyperspectral data processing; Applications in geology: the VIS-SWIR range, the TIR range.

UNIT III

Information Extraction from hyperspectral Data, Data Vs information, Classification Style/Intent, Supervised and Unsupervised Classification, Feature Extraction, Whole pixel analysis - Spectral angle mapper, Spectral feature fitting; Sub-Pixel analysis – Linear spectral unmixing, Matched filtering.

UNIT IV

Information contained in an image, Concept of a Hyperspectral Cube, Pattern recognition, Software tools, Hyperspectral and Ultraspectral Information Extraction Approaches, The Importance of Endmembers, Spectral Libraries, Pixel unmixing, Spectral maps, Applications of hyperspectral remote sensing in agriculture, environment, and forestry.

Books Recommended:

Marcus Borengasser, William S. Hungate and Russell Watkins (2008) Hyperspectral Remote Sensing: Principles and Applications. CRC Press

Chein-I Chang (Ed) (2007). Hyperspectral Data Exploitation: Theory and Applications. John Wiley & Sons.

Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session: 2015-2016

Semester-II

Contact hours: 28 (including tutorials)
Credits 2

Paper 15

Digital Terrain Modeling

UNIT I

Digital Terrain Models, Creating and Using a Digital Terrain Model: theoretical issues, Types of DEMs, Data sources for digital terrain modeling: Terrain surface, aerial and space images, topographic maps, Production of DEMs, Availability of DEMs.

UNIT II

DTM interpretation: Automated terrain analysis to support GIS modeling; Interpretation for geomorphometric analysis; Interpretation for planning and engineering applications; DTM visualization.

UNIT III

Analysis of Digital elevation data; DTA Software; Surface derivatives (including slope, aspect and drainage); Environmental modeling with elevation data; Basin morphometric studies with DEMs.

UNIT IV

Applications of DEMs: Planning and Resource Management: Land-use modelling (e.g., slope stability, forest fires, agricultural production); Pollution monitoring and environmental management, Line of sight assessment, Battle planning.

Books Recommended:

Li, Z., Zhu, Q. and Gold, C. (2005). Digital terrain modeling: principles and methodology. CRC Press.

Naser El-Sheimy, Caterina Valeo, and Ayman Habib (2005). Digital Terrain Modeling: Acquisition, Manipulation and Applications. Artech Publishers.

John P. Wilson & John C. Gallant (Eds) (2000). Terrain Analysis : Principles and Applications. New York: Wiley

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester III

Paper-12

(Special Paper)

Remote Sensing and GIS Applications in Land use Planning-I

Unit I:

Urban Land Use Mapping: Relevance of RS & GIS in urban studies; Urban area classification; Monitoring of Urban Plan and change detection; Urban land use/land cover classification and mapping; Urban mapping, zonation and field verifications.

Unit II:

Urban Growth Monitoring: Detection and identification urban objects on aerial photographs at different scales; Urban area interpretation and analysis using multi -scale imageries; Urban growth monitoring.

Unit III:

Residential Area Interpretation and Population estimation: Residential area interpretation using vertical aerial photographs and satellite imageries; Urban population estimation.

Unit IV:

Urban Issues and Hazards: Monitoring of urban environment; Urban facility mapping; Traffic survey; Solid waste management

Suggested Books:

Drury, S.A., 1987: Image Interpretation in Geology. Allen and Unwin
Gupta, R.P.., 1990: Remote Sensing Geology. Springer Verlag.
Jensen,J.R. 2000 : Remote Sensing of the Environment: An Earth resource Perspective. Prentice Hall
Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation, John Wiley.
Paine, D.P.,1981: Aerial Photography and Image Interpretation for Resource Management. John Wiley.
Sabbins, F.F., 1985: Remote sensing Principles and interpretation. W.H.Freeman and company

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2015-16

Semester IV

Paper-16

(Special Paper)

Remote Sensing and GIS Applications in Land use Planning-II

Unit I:

Land use classification. Spectral signatures of various land use classes. Identification and delineation on satellite images. Land use and land cover differentiation.

Unit II:

Mapping of various land use land cover features on remotely sensed data. Cultivated land, uncultivated land, barren land, built up land, industrial land, wasteland, saline alkaline land, rocky terrain.

Unit III:

Mapping of land cover types. Forest, water bodies, reservoirs, snow and ice. Spectral signatures and their interpretation. Case studies and examples.

Unit IV:

Land use land cover mapping from multi-temporal satellite data. Change detection analysis and change matrix. Drivers of land use change. Global land use land cover changes.

Suggested Books:

Drury, S.A., 1987: Image Interpretation in Geology. Allen and Unwin
Gupta, R.P.., 1990: Remote Sensing Geology. Springer Verlag.
Jensen,J.R. 2000 : Remote Sensing of the Environment: An Earth resource Perspective. Prentice Hall.
Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation, John Wiley.
Paine, D.P.,1981: Aerial Photography and Image Interpretation for Resource Management. John Wiley.
Sabbins, F.F., 1985: Remote sensing Principles and interpretation. W.H.Freeman and company