Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester IV

Session 2016-17

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 and potential of renewable and non-renewable 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

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Session: 2016-2017

Semester-IV

Contact hours: 28
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.

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Session: 2016-2017

Semester-II

Contact hours: 28
Credits 2

Paper 15

Digital Terrain Modeling

UNIT I: Definition - Digital Terrain Model (DTM), Digital Elevation Model (DEM) and Digital Surface Model (DSM), Mathematical and Digital Models of the Land Surface; Digital Elevation Data Sources and Structures; DTM/DEM Production Methods; DEM Interpolation Methods; Early DEMs; Availability of Global and Regional DEMS.

UNIT II: Error and Uncertainties in DEM/DTM - Typology of Error (gross errors or blunders, systematic errors and random errors), Describing Errors (RMSE, ME and S); Sources of Error in DEMs (method of source data generation, processing and interpolation and terrain representation); Error Models; Error Propagation; Visualization of error; Error Correction and Fitness for Use; Optimization of DEM Resolution; DEM/DTM interpretation.

UNIT III: DEMs for Geomorphometric Analysis; Flow Direction Algorithms (D8, D∞); Surface derivatives (Slope, Aspect, Curvature, Hill Shade, Contours and Drainage); Basin Morphometry; Overview of Software Packages Used in Terrain Modeling - Terrain Modeling in ESRI Packages Terrain Modeling in SAGA, Terrain Modeling in MicroDEM, Terrain Modeling QGIS, Terrain Modeling in GRASS.

UNIT IV: Applications of DEMs: Terrain Analysis in Soil Mapping; Landslide and Slope Stability Analysis; Terrain Analysis in Hydrology; Landscape Studies; Landuse Classification and Predictive Vegetation Mapping; Effect of Data Source, Grid Resolution and Flow Routing on Topographic Attributes; Future Directions for Terrain Analysis.

Books Recommended:

Hengl, T., Reuter, H.I. (eds) 2008. Geomorphometry: Concepts, Software, Applications. Developments in Soil Science, vol. 33, Elsevier, 772 pp

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

Fisher, Peter F., and Nicholas J. Tate. "Causes and consequences of error in digital elevation models." Progress in physical Geography 30, no. 4 (2006): 467-489. **(Journal Article)**

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2016-17

Semester IV

Credit 4

Elective (E4)

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

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Session 2016-17

Semester IV

Elective (E-4)

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. Interlinking of rivers: prospects and challenges

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

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Semester IV

Elective (E-4)

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.
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RLM-7 (Lab-7) (for paper13and E4) (2 credits)

Exercises related to natural resources degradation. Water, soil, forest. Mapping of degraded land, water scarce areas, water logged areas, forest degraded areas. Assessment of natural resources based on temporal data. Exercises on remote sensing and GIS applications in water resources, geosciences and land use.

RLM-8 (Lab-8) (for Papers 14 and 15) (2 credits)

Exercises related to hyperspectral data analysis. Spectra of various rock types, minerals and land uses. Hyperion data and analysis. Digital; terrain modelling: parameters for modelling. Surface run off modelling, slope and aspect analysis. Watershed modelling.

RLM-9 (Lab-9)

Project Oriented dissertation (4 credits)

RLM-10 (Lab 10)

Presentation and Viva voce on project dissertation (2 credits)

Elective (E-4) (4 credits)

Remote sensing and GIS Applications in Geosciences-I
Remote sensing and GIS Applications in Water Resources-I
Remote sensing and GIS Applications in Land use planning-I

Open Elective: (4 credits)

Fundamentals of remote sensing & GIS