SYLLABUS
FOR THE SESSION
2017-2018

M.Sc. (Remote Sensing and GIS Applications)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER-I to IV

INTERDISCIPLINARY DEPARTMENT OF
REMOTE SENSING AND GIS APPLICATIONS
ALIGARH MUSLIM UNIVERSITY
ALIGARH
<table>
<thead>
<tr>
<th>Type of Course</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Marks distribution</th>
<th>Credit</th>
<th>Contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>RSM-1</td>
<td>Remote Sensing and Image interpretation</td>
<td>10 30 60 100</td>
<td>4</td>
<td>48 08 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-2</td>
<td>Fundamentals of GIS and GPS</td>
<td>10 30 60 100</td>
<td>2</td>
<td>24 04 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-3</td>
<td>Basic Statistics and Computer Programming</td>
<td>10 30 60 100</td>
<td>4</td>
<td>48 04 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-4</td>
<td>Aerial Photography and Photo-grammetry</td>
<td>10 30 60 100</td>
<td>2</td>
<td>24 04 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-5</td>
<td>Data structure and Data bases</td>
<td>10 30 60 100</td>
<td>2</td>
<td>24 04 0</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-1</td>
<td>Lab work: Practical for paper I and IV</td>
<td>Continuous evaluation 40</td>
<td>2</td>
<td>0 02 04</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-2</td>
<td>Lab Work: Lab work: Practical for paper II,III and V</td>
<td>Continuous evaluation 40</td>
<td>2</td>
<td>0 01 02</td>
</tr>
<tr>
<td>Ability Enhancement</td>
<td>AE-1</td>
<td>Field Work/GPS/ground truth survey</td>
<td>40 - 60 100</td>
<td>2</td>
<td>0 01 02</td>
</tr>
<tr>
<td>Elective (Discipline Centric)</td>
<td>E-1 (a) Global Climate Change (b) Basic programming Concepts</td>
<td>10 30 60 100</td>
<td>4</td>
<td>48 8 0</td>
<td></td>
</tr>
</tbody>
</table>
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-I
Session: 2017-2018

Contact hours: 56
Credits 4

Paper-1 (RSM-1001)

Remote Sensing & Image Interpretation

Unit-I

Unit-II
Sensors and their characteristics on board IRS, LANDSAT, SPOT, NOAA, IKONOS, Quickbird satellites. ASTER and SRTM missions. Spectral reflectance of soil, water vegetation and rock types. Spectral, spatial, temporal and radiometric resolutions.

Unit-III

Unit-IV
Mapping from remotely sensed data: Image characteristics of Flood inundation, cyclone affected areas, environmentally degraded areas, degraded land and desertified areas. Examples and case studies from India.

Suggested Books:

2. Remote Sensing and image interpretation by Lillesand and Keifer
5. Remote Sensing and Geographical Information System by Anji Reddy
6. Principal of Remote Sensing by P.J. Curran

Web sources:

www.isro.org
www.nrsc.gov.in
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-I
Session: 2017-2018
Contact hours: 28
Credits 2

Paper-2 (RSM-1002)
Fundamentals of GIS & GPS

Unit-I

Unit-II
Basics of GIS: data, structure, relational, hierarchical net work input, format, analysis in GIS. Data integration and overlay analysis in GIS. Functions of GIS. Digitization, editing and topology building in GIS. Concept and applications of Digital Elevation Model (DEM). Data Base Management System (DBMS).

Unit-III
Introduction to Global positioning system: GPS satellite constellations, GPS segments: space, control, user, signals & codes. GPS receivers. Operating principle and sources of errors in GPS. Modes of measurements and Post processing of data, accuracy of GPS observation. GPS applications in various fields. Concept of DGPS and WAAS.

Unit-IV
Applications of GIS in natural resources mapping, socio-economic mappings and infrastructure mapping. Utility of GPS surveys in various fields. Case studies and examples from India.

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
5. www.GISdevelopment.net
Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-I
Session: 2017-2018
Contact hours: 56
Credits 4

Paper-3 (RSM-1003)

Basic Statistics and Computer Programming

Unit I
Introduction, Descriptive Statistics: Measures of Location, Measures of Variability, Skewness and Kurtosis, Data Visualization: Histograms, Box Plots, Scatter Plots

Unit II
Probability and Probability Distributions, Probability and Its Properties, Probability Distributions, Expected Value and Moments, Joint Distributions and Independence, Covariance and Correlation

Unit III

Unit IV
R: Introduction to computer programming and software packages, vectors and assignment, vector arithmetic, arrays and matrices, lists and data frames. Import/export of data objects, Defining new functions, Elements of graphics with R, Numeric and graphic summaries of data.

Suggested Books:

4. W. N. Venables, D. M. Smith and the R Core Team: An Introduction to R Notes on R: A Programming Environment for Data Analysis and Graphics
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-I
Session: 2017-2018
Contact hours: 28
Credits 2

Paper-4 (RSM-1004)

Aerial Photography and Photogrammetry

Unit-I
Aerial photographs: Classification of aerial photographs. Scale of aerial photographs on uniform and variable terrain. Geometry of aerial photographs. Types of aerial mosaics and their advantages. Types of aerial cameras

Unit-II

Unit-III
Detections and identification of defined objects. Interpretation of physical and cultural features: hills/ridges, valleys, plains, plateau, settlement, infrastructures, water ways etc. Interpretation, delineation and mapping of general land use. Wasteland identification and classification.

Unit-IV

Suggested Books:
- Remote Sensing of the Environment by J.R. Jenson
- Photogeology by V.C. Miller
- Photogrammetry by F.H. Moffitt and EM Mikhail
- Principles and applications of photogeology by S.N. Panday
Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing and GIS Applications)

Semester I
Session 2017-2018
Paper-5 (RSM-1005)

Data Structure and Data Bases

Unit-I LINEAR DATA STRUCTURE
Introduction to data structures, linear and non-linear data structures, concepts of data types, single dimensional arrays, multi-dimensional arrays, operations on arrays, introduction to linked list, applications of linked list, doubly linked list, representation of stack and queues, use of stack and queues.

Unit-II NONLINEAR DATA STRUCTURE
Hierarchical form of data structure, introduction to trees, binary tree, binary search trees, traversal of binary trees: inorder, preorder, postorder, searching and inserting elements in binary trees, introduction to graph, representation of graph, traversing the graph, concept breadth first search, concept of depth first search.

Unit-III INTRODUCTION TO DATABASE
Database and its purpose, characteristics of database approach, database systems and their needs, components of database system, database System architecture, database administrator and his role, database management system and its components, types of database management systems, RDBMS, OODBMS, ORDBMS etc.

Unit-IV DATABASE MODEL

Suggested Books:

Data Structures by Lipschutz (Schaum’s outline series)
Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester I

Session 2017-18

RLM-1 (Lab-1) (Papers 1 and 4) (2 credits) (RSM-1071)


RLM-2 (Lab-2) (Papers 2, 3 and 5) (2 credits) (RSM-1072)

Toposheet identification and reading. Exposure to GIS software: Data digitization, editing, topology building. Georeferencing and GCPs. Projection and Coordinate system in GIS. Spatial and non-spatial data and their linkage in GIS. Spatial analysis: Overlay, buffer, proximity & network analysis. GPS measurements and mapping. Use of GPS in field work/survey. Exercises related to Data structure and data bases

Ability Enhancement (AE-1) (2 credits) (RSM-1073)

Field work/Ground truth/GPS survey

Elective (Discipline Centric) E-1 (4 Credits)

(a) Global climate Change

(b) Basic programming concepts
Interdisciplinary Department of Remote Sensing & GIS Applications

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

Semester I
Session 2017-2018

Elective Paper (E1) (RSM-1011)  
(Discipline Centric)

Global Climate Change

**Unit I**  

**Unit II**  
Composition and structure of the atmosphere, Importance of atmosphere to human life, Change in atmospheric composition in the recent time. Burning of fossil fuel, deforestation, global land use/land cover changes. Green house gases and their effects.

**Unit III**  

**Unit IV**  
Sea level rise- causes, impacts and adaptation measures. UNCCC-role, summits, declarations, and protocols on climate change and its mitigation. Role of IPCC in policy making.

**Suggested books:**

Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing and GIS Applications)

Semester I
Session 2017-2018
Contact hours 56
Credit 4

Elective Paper (E1) (RSM-1013)
(Discipline Centric)

Basic Programming Concepts

Unit-I INTRODUCTION
Introduction to programming, Introduction to ‘C’, Importance of ‘C’ language, program structure, data types, variables, expressions, statements, operators, input-output functions, some basic programs.

Unit-II JUMPING, BRANCHING, LOOPING
Decision making statements: IF, IF-ELSE, NESTED IF-ELSE, SWITCH-CASE, Repetitive statements: FOR, WHILE, DO-WHILE, Structured programming, break and continue statements, array handling, handling of character strings, some programs practice.

Unit-III BASIC DATA STRUCTURE
Introduction to linear and non-linear data structures, Arrays and its memory representation, two-dimensional arrays, program on matrices, character of array, introduction to linked list, stack and queues, introduction to trees and graphs.

Unit-IV OPERATIONS OF DATA STRUCTURE
Operations of data structure: traversing, searching, inserting, deleting, linear search, binary search method, arranging the elements in order, sorting: insertion, selection, bubble, merging of two arrays, and creation of linked list.

Suggested Books:

Programming in C by Gottfried B. S. (Schaum’s outline series)
Introduction to C by Yeshwant Kanitakr
Data Structures by Lipschutz S. (Schaum’s outline series)
## Second Semester

<table>
<thead>
<tr>
<th>Type of Course</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Marks distribution</th>
<th>Credit</th>
<th>Contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>RSM-6</td>
<td>Digital Image Processing</td>
<td>10 30 60 100 4</td>
<td>4</td>
<td>48 08 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-7</td>
<td>Thermal and Microwave Remote Sensing</td>
<td>10 30 60 100 2</td>
<td>2</td>
<td>24 04 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-8</td>
<td>Earth Systems</td>
<td>10 30 60 100 2</td>
<td>2</td>
<td>24 04</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-9</td>
<td>Advanced Statistics for GIS &amp; Spatial data analysis</td>
<td>10 30 60 100 4</td>
<td>4</td>
<td>48 08 0</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-3</td>
<td>Lab work: Practical for papers 6 and 9</td>
<td>Continuous evaluation 40</td>
<td>2</td>
<td>02</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-4</td>
<td>Lab Work: Practical for papers 7 and 8</td>
<td>40 - 60 100 2</td>
<td>2</td>
<td>02</td>
</tr>
<tr>
<td>Ability</td>
<td>AE-2</td>
<td>Seminar Presentation</td>
<td>40</td>
<td>4</td>
<td>02</td>
</tr>
<tr>
<td>Enhancement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>E-2</td>
<td>(a) Geography of India</td>
<td>10 30 60 100 4</td>
<td>4</td>
<td>2 0 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Mineral resources of India</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-II  
Contact hours: 56

Session: 2017-2018  
Credits 4

Paper-6 (RSM-2001)

Digital Image Processing

Unit-I

Unit-II
Overview of Software Tools in Image Processing; Open Source Image Processing Software; Image Enhancement Techniques; Gray Level Transformations; Histogram Processing; Enhancement Using Arithmetic/Logic Operation; Density slicing; Geometric Corrections; Image Registration – Definition, Principle and Procedure; Radiometric Correction;

Unit-III
Basics of Spatial Filtering; Convolutions and Morphology (High Pass, Low Pass, Laplacian; Gaussian; Sobel; Roberts, Erode, Dilate); Adaptive Filtering (Lee, Frost, Gamma, Kuan); Image Sharpening; Principal Component Analysis; Minimum Noise Fraction (MNF) Transformation; Color Image Processing; RGB Color Model; Generation of FCC’s; Image transformation – Intensity Hue Saturation (HIS).

Unit-IV
Pattern Recognition and Image Classification; Image Segmentation; Unsupervised Classification – advantage, disadvantage and limitations. Supervised Classification - training site selection, Classifiers used in supervised classification – Minimum distance to mean, Parallelepiped, maximum likelihood, Classification Accuracy Assessment; Band Ratios; NDVI : utility and applications.

Suggested Books:

2. Image Interpretation in Geology. Allen and Unwin
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-II

Session: 2017-2018

Contact hours: 28

Credits 2

Paper-7 (RSM-2005)

Thermal and Microwave Remote Sensing

Unit I

Unit II
Active microwave system components. Slant range versus ground range RADAR image geometry. Relief displacement, image foreshortening, layover, shadows and speckle. Synthetic aperture radar system, surface roughness characteristics. Electrical characteristics and relationship with moisture content.

Unit III
SAR remote sensing- Seasat, Shuttle Imaging Radar series, RADARSAT, ERS-I, JERS-1, Almaz-1, RISAT, RADAR interferometry, topographic mapping, velocity mapping. Light detection and ranging (LIDAR) sensor system, accuracy, penetration capability and measurements.

Unit-IV
Thermal infrared images and applications in vegetation/forestry, water resources, forest fires, volcanic eruptions. Recent advances in thermal infrared remote sensing: advantages and limitations.

Suggested Books:

1. Remote sensing of the Environment by J R Jenson
Interdisciplinary Department of Remote Sensing and GIS Applications

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

Semester-II

Contact hours: 28

Session: 2017-2018

Credits 2

Paper 8 (RSM-2003)

Earth Systems

**Unit I**

**Unit II**

**Unit III**

**Unit IV**
Cycles in the earth system - hydrologic cycle, carbon cycle, biogeochemical cycle and rock cycle. Earth system science organization (ESSO): components, principle and operations. Early warning systems. Application of remote sensing in monitoring components of earth systems.

**Books Recommended:**

Advanced Statistics for GIS and Spatial Data

Unit I

Unit II
Multivariate Statistics: Multivariate random sample, Multivariate mean, standard deviation, and sample correlation coefficient with their geometric interpretation, the generalized variance, Distances in p-dimensional space, Multivariate normal distribution, Mahalanobis distance. Introduction to spatial variation.

Unit III
Multivariate inference and Principal Component Analysis: Inference about mean vector, testing the multivariate population mean, Finding Principal components, Interpretation of principal component loadings, scaling of variables, Fair-Share Stopping rules, Principal component score, Imaging related sampling schemes.

Unit IV
Discrimination and classification: Supervised Learning: classification for two populations, linear and quadratic discriminant analyses; Unsupervised Learning: Similarity and dissimilarity measures for observations and for variables and other objects; Clustering algorithm: Single linkage algorithm; Non-hierarchal Clustering Method: K-means Method.

Suggested Books:

Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester II

Session 2017-18

RLM-3 (Lab-3) (Based on Papers 6 & 9) (2 Credits) (RSM-2071)


Linear and multiple regression, Multivariate Inference, Principal component analysis, finding Mahalanobis distance, cluster analysis, linear and quadratic discriminant analyses.

RLM-4 (Lab-4) (Based on Papers 7 & 8) (2 Credits) (RSM-2072)


Ability Enhancement (AE-2) (4 Credits) (RSM-2073)

Seminar presentation

Elective (Discipline Centric) E2 (4 Credits)

(a) Geography of India

(b) Mineral Resources of India
Interdisciplinary Department of Remote Sensing & GIS Applications

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

Session: 2017-2018

Semester-II

Contact hours: 56
Credits 4

*Elective Paper (E2) (RSM-2011)*

*(Discipline Centric)*

Geography of India

**Unit I**
Major geographical features of India. Bases of Physiographic divisions of India; Peninsular and Extra Peninsular India- its Evolution and Geological structure. Their physical and topographic characteristics.

**Unit II**
Drainage and water resources. Major river system of India and their morphological characters. Evolution of extra peninsular drainage and peninsular drainage, characteristics of their major river systems. Difference between peninsular and extra peninsular drainage systems.

**Unit III**

**Unit IV**
Soil structure, texture, reaction and profile. Factors determining the types of soil, distribution and characteristics. Major areas affected by soil erosion, soil erosion and conservation. Problems of soils and its measures of reclamation.
Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-II
Session: 2017-2018

Contact hours: 56
Credits 4

Elective Paper (E2) (RSM-2012)

(Discipline Centric)

Mineral Resources of India

Unit I
Metallic and non-metallic minerals. Occurrence, distribution and reserves in India. Mineral resources in geological periods. Distribution of mineral deposits in space and time.

Unit II
Iron ore deposits, distribution, production and reserves. Copper ores and their distribution. Lead and zinc deposits. Gold and diamond deposits in India.

Unit III
Radioactive mineral deposits: occurrence, distribution and production of uranium and thorium. Coal resources: reserves, production and distribution. Oil and gas basins of India.

Unit IV

Books suggested:

1. India’s Mineral resources by Krishnaswami
2. Ore deposits of India by Gokhle and Rao
3. Industrial minerals and rocks by Deb
<table>
<thead>
<tr>
<th>Type of Course</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Marks distribution</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>RSM-10</td>
<td>Application of Remote sensing in Natural hazards</td>
<td>10 30 60 100</td>
<td>4 48 08 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-11</td>
<td>Cartography, Mapping and GIS techniques</td>
<td>10 30 60 100</td>
<td>4 48 08 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-12</td>
<td>Data mining &amp; Software Application</td>
<td>10 30 60 100</td>
<td>4 48 08 0</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-5</td>
<td>Lab work: Practical for paper 10 and 11</td>
<td>10 30 60 100</td>
<td>2 02</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-6</td>
<td>Lab work: Practical for paper 12 and E3</td>
<td>10 30 60 100</td>
<td>2 02</td>
</tr>
<tr>
<td>Ability Enh</td>
<td>AE-3</td>
<td>Field Work/GPS/Ground truth survey</td>
<td>40 60 100 4</td>
<td>0 0</td>
</tr>
<tr>
<td>Elective (DC)</td>
<td>E-3</td>
<td>Choose 01 course of the following:</td>
<td>10 30 60 100</td>
<td>4 48 8 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remote sensing &amp; GIS applications in geo-sciences-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remote sensing &amp; GIS applications in water resources-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remote Sensing &amp; GIS applications in Land use planning-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remote sensing &amp; GIS applications in Forestry and Ecology - I</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remote sensing &amp; GIS applications in Soils and agriculture-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remote sensing &amp; GIS applications in Environmental management-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td>24</td>
</tr>
</tbody>
</table>
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2017-18

Semester III

Contact hours: 56

Credit 4

Paper-10 (RSM-3001)

Application of Remote Sensing in Natural Hazards

Unit-I
Natural hazards: Concept of natural hazard. Types and classification of natural hazards: Causes, effects, monitoring, management of Earthquakes, Volcanic eruptions, Tsunamis. Role of remote sensing in monitoring and damage assessment. History of natural hazards in India. Vulnerable states and regions of India. Vulnerability index of various natural hazards in India. Preventive measures. Earthquake and Tsunami warning system in India

Unit-II
Causes, effects and management of floods, cyclones, draughts, landslides. Application of remote sensing in monitoring, management and damage assessment of these hazards. Case studies and examples from India. Indian policies and programmes to tackle natural hazards at state and national level.

Unit-III
Causes, effects and impacts of desertification and land degradation. Monitoring and mapping desertification from space data. Wasteland classification. Application of remote sensing and GIS in wasteland mapping. Spatial and non-spatial data for monitoring and management of natural hazards. Case studies and examples from India.

Unit-IV
Water logging and salinization hazards- role of remote sensing in mapping and monitoring. Remote sensing application in post hazards rehabilitation and resettlement. Role of NGOs in post hazards measures. GIS data for Decision support system. Stakeholders participation in natural hazard monitoring and management.

Suggested readings:
Web resources of Govt. Of India, Ministries of S&T, Earth Sciences, IMD, ISRO, Env,& Forest etc.
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2017-18

Semester III

Credit 4

Paper-11(RSM-3002)

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
5. www.GISdevelopment.net
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2017-18

Semester III

Credit 4

Paper 12 (RSM-3003)

Data mining and software application

Unit-I
Basic Concepts: Data Mining, Data and Patterns, Review of statistical Techniques for Data Mining: discriminant Analysis, cluster Analysis, Outlier Analysis.

Unit-II
Data Mining of Spatial Data: Geospatial Grids, Data structures for Spatial Grids.

Unit-III
Introduction to Advanced Methods of Classification: Genetic Algorithms, Fuzzy Set Approach, Decision Trees, Neural Networks.

Unit-IV
Introduction to the Data Mining Software Packages, Data Mining using R. Software.

Books Recommended:

1. Jiawei Han, Micheline Kamber, Jian Pei (2011): Data Mining: Concept and Techniques, Elsevier.


Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2017-18

Semester III

Credit 4

Elective (E3) (RSM-3011)

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:

2. Remote Sensing and image interpretation by Lillesand and Keifer
5. Remote Sensing and Geographical Information System by Anji Reddy
6. Principal of Remote Sensing by P.J. Curran
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2017-18

Semester III

Elective (E3) (RSM-3012)

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 their characteristics. 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
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2017-18

Semester III

Elective (E-3) (RSM-3013)

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:
Interdisciplinary Department of Remote Sensing & GIS Applications

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

Semester III

Session 2017-18

**RLM-5 (Lab-5)** (for Papers 10 and 11) (2 credits) (RSM-3071)


**RSM-6 (Lab-6)** (for Papers 12 and E3) (2 credits) (RSM-3072)

Statistical analysis and data mining. Meta data and software application. R software. Exercises related to application of remote sensing in geosciences/water resources/land use.

**Ability Enhancement (AE-3)** (4 credits) (RSM-3073)

Field work/GPS survey/Ground truth mapping

**Elective (E-3)** (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
<table>
<thead>
<tr>
<th>Type of course</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Marks distribution</th>
<th>Credit</th>
<th>Contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sessional Mid Semester End Semester Total</td>
<td></td>
<td>L  T  P</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-13</td>
<td>Application of remote sensing in Natural Resources</td>
<td>10 30 60 100</td>
<td>2</td>
<td>24 04 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-14</td>
<td>Hyperspectral remote sensing</td>
<td>10 30 60 100</td>
<td>2</td>
<td>24 04 0</td>
</tr>
<tr>
<td>Core</td>
<td>RSM-15</td>
<td>Digital terrain modelling</td>
<td>10 30 60 100</td>
<td>2</td>
<td>24 04 0</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-7</td>
<td>Lab work: Paper 13 and E4</td>
<td>40 60 100</td>
<td>2</td>
<td>2 0 02</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-8</td>
<td>Lab work: Papers 14 &amp; 15</td>
<td>40 60 100</td>
<td>2</td>
<td>2 0 02</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-9</td>
<td>Project Oriented Dissertation <em>(To be allotted after second semester exam or at the beginning of third semester)</em> Choose 01 course of the following:</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>Core</td>
<td>RLM-10</td>
<td></td>
<td>100</td>
<td>2</td>
<td>2 0 02</td>
</tr>
<tr>
<td>Elective (DC)</td>
<td>E-4</td>
<td></td>
<td>100</td>
<td>4</td>
<td>0 0 02</td>
</tr>
<tr>
<td>Open Elective</td>
<td>OE</td>
<td>Fundamentals of remote sensing &amp; GIS</td>
<td>10 30 60 100</td>
<td>4</td>
<td>4 0 0</td>
</tr>
</tbody>
</table>

**Total**

24

**Grand Total (1st+2nd+3rd+4th) Semesters**

96

L= Lecture period, T= Tutorial, P= Practical Period
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester IV

Session 2017-18

Credit 4

Paper-13 (RSM-4001)

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
Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session: 2017-2018

Semester-IV

Contact hours: 28
Credits 2

Paper-14 (RSM-4002)

Hyperspectral Remote Sensing

Unit-I

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

Books Recommended:


Interdisciplinary Department of Remote Sensing & GIS Applications

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

Session: 2017-2018

Semester-II

Contact hours: 28

Credits 2

Paper 15 (RSM-4003)

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:


Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Session 2017-18

Semester IV

Credit 4

Elective (E4) (RSM-4011)

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:

2. Remote Sensing and image interpretation by Lillesand and Keifer
5. Remote Sensing and Geographical Information System by Anji Reddy
6. Principal of Remote Sensing by P.J. Curran
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:
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:

Unit III:

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:
Interdisciplinary Department of Remote Sensing & GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester IV

Session 2017-18

RLM-7 (Lab-7) (for paper 13 and E4) (2 credits) (RSM-4071)

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) (RSM-4072)


RLM-9 (Lab-9) (RSM-4073)

Project Oriented dissertation (4 credits)

RLM-10 (Lab 10) (RSM-4074)

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) (RSM-4091)

Fundamentals of remote sensing & GIS
Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-IV
Session: 2017-2018

Contact hours: 56
Credits 4

OPEN ELECTIVE (RSM-4091)

Fundamentals of Remote Sensing & GIS

Unit-I

Unit-II
Types of satellites. Sensors and their characteristics on board IRS, LANDSAT, SPOT, NOAA, IKONOS, Quickbird satellites. ASTER and SRTM missions. Spectral reflectance of soil, water vegetation and rock types. Spectral, spatial, temporal and radiometric resolutions.

Unit-III
Basics of GIS. Data, structure, relational, hierarchical net work input, format, analysis in GIS. Map projections. Datum and coordinate systems. Data integration and overlay analysis in GIS. Functions of GIS.

Unit-IV

Suggested Books:

1. Remote Sensing and image interpretation by Lillesand and Keifer
2. Fundamentals of Remote Sensing by George Joseph
5. Principal of Remote Sensing by P.J. Curran
6. Introduction to GIS by P. Longley et al
7. Fundamentals of GIS by Micheal Demers