

KUMAUN UNIVERSITY

SCHEME OF EXAMINATION AND COURSES OF STUDY



M.Sc. Remote Sensing and GIS

**CENTRE OF EXCELLENCE FOR NRDMS IN UTTARAKHAND
DEPARTMENT OF GEOGRAPHY KUMAUN UNIVERSITY
SSJ CAMPUS, ALMORA-263601 UTTARAKHAND**

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Semester-I
Paper Code: 101
FUNDAMENTALS OF SPATIAL MATHEMATICS AND GEOGRAPHY
Paper-I

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	<p>Spatial Mathematics Basics of Geometry- Point, Lines, Line Segment, Ray, Angle and their measures, Plane, Parallel Line, Intersecting Lines, Vertex, Circle, Ellipse; Trigonometry- Basic concepts and properties of trigonometric functions; Coordinates Geometry; Logarithm; Basics of Set Theory; Linear Algebra- Number, Complex number, Quadratic equation; Matrices; Probability.</p>
UNIT-II	<p>Fundamentals of Computers Introduction to Computers; Data Representation; Input/Output units; Computer Memory; Introduction to Computer Programming; Development of algorithms and flow chart; Introduction to C language; C++ language - Introduction, Objects, Decisions, Loops, Functions, Structs, References, Classes, Pointers.</p>
UNIT-III	<p>Basics of Geography The World in Spatial Term -Human Cognition of Spatial World, Geographic Data, Digital Geographic Information; Geographic Directions; Position on Earth; Geographic Coordinates; Map Scale; Map Projection; Elements of Map Representations; Shape of the Earth, Introduction to Geodetic Datum; Gravity of the Earth; Dimensions of the Earth; Georeferencing.</p>
UNIT-IV	<p>Basics of Statistics Introduction to Statistics; Characteristics of Statistical Data; Statistical Methods; Collections of data- primary and secondary data sources, Measurement of Central Tendency- Mean, Mode, Median, Geometric mean and Harmonic Mean; Measures of variations - Range, Quintile deviations, Mean deviation, Standard deviation and variance, Coefficient of variations.</p>
UNIT-V	<p>Advanced Statistics Theory of Sampling, Hypothesis of Testing; Correlation Analysis; Regression Analysis;</p>

BOOKS RECOMMENDED

1. Mahmood, A. *Statistical Methods in Geographical Studies*, Rajesh Publications, 1977.
2. Alvi, Z 1995, *Statistical Geography-methods and applications*, Rawat Publications, New Delhi.
3. King,L.J., *Statistical Analysis in Geography*, Prentice –Hall, 1969.
4. Statistics by S.P. Gupta.
5. Lecture Notes, PRS Division, IIRS Dehradun, 2007.

Semester-I
Paper Code: RS/GIS-102
Principles of Aerial Photographs and Photogrammetry
Paper-II

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	<p>Aerial Photographs and Photography Introduction to aerial photography – Basic information and specifications of aerial photographs; Planning and execution of photographic flights Basic; Geometric Characteristics of Aerial Photographs- Types of Aerial Photograph, Flight Strips, Nadir Line, End Lap; Side Lap, Stereoscopic Coverage and Stereopairs, Intervalometer, Air Base and Base Height Ratio; Types of Aerial Camera.</p>
UNIT-II	<p>Fundamentals of Photogrammetry Definitions and Development of Photogrammetry; Classifications of Photogrammetry; Uses of Photogrammetry; Soft-Copy Photogrammetry- Interior Orientation, Exterior Photogrammetry, Aero-Triangulation</p>
UNIT-III	<p>Photographic Scale Concept of Photographic Scale; Methods for Determining Photo Scale; Scale of a Vertical Photograph over Flat Terrain; Scale of a Vertical Photograph over variable Terrain; Other methods for determining scale of Vertical Photographs; Scale of Tilted Photograph</p>
UNIT-IV	<p>Relief Displacement and Orthorectification Relief Displacement- Characteristics of Relief Displacement; Object Height Determination from Relief Displacement measurement; Correcting for Relief Displacement; Orthorectification- Introduction; Advantages and uses of orthophotos; Automatic Contouring during orthophotos production; Flight planning for orthophotograph.</p>
UNIT-V	<p>Stereoscopic Viewing and Stereoscopic Parallax Depth Perception; Stereoscopic Depth Perception; Viewing Photographs Stereoscopically; Use of Stereoscope; Stereoscopic Methods of Parallax Measurement-Causes of X and Y Parallax; Stereoscopic Parallax Equation;</p>

BOOKS RECOMMENDED

- 1 American Society Of Photogrammetry, 1983: Manual Of Remote Sensing (2nd Edition), ASP Falls Church, Virginia.
- 2 Aerial photographic interpretation, Lueder, D.R., McGraw Hill Book Co., 1959 Elements of Photogrammetry, Paul R. Wolf, McGraw-Hill, 2000.
- 3 Digital Elevation Model Technologies and Applications: The DEM user Manual,
- 4 David F. Maune (ed), American Society for Photogrammetry and Remote Sensing, Bethesda, MaryLand, USA, 2001.
- 5 Drury S.A, 1990: A Guide To Remote Sensing - Interpreting Images Of Earth, Oxford Science Publications, Oxford.
- 6 Lecture notes, 1st module ,PRS division IIRS Dehradun.2007

- 7 Leica Photogrammetry Suite – Orthobase and Orthobase Pro User Guide, Leica Geosystems, GIS & Mapping, Atlanta, USA, 2003.
- 8 Lillisand, T.M. And P.W.Kiefer, 1986: Remote Sensing And Image Interpretation, John Wiley & Sons, New York.
- 9 Manual Photogrammetry, McGlone, C., Edward, M. and Bethel, J, American Society For Photogrammetry and Remote Sensing, Bethesda, Maryland, USA. 2005.
- 10 Paul R. Wolf, Elements of Photogrammetry, McGraw-Hill Science, 2001.

Semester-I
Paper Code: RS/GIS-103
Principles of Satellite Remote Sensing
Paper-III

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	<p>Concepts of Remote Sensing Introduction; Definition and Scope; Stages of Remote Sensing data acquisition; Process of Remote Sensing data analysis; Type of Remote Sensing- Active and passive remote sensing; Advantages and Limitations of Remote Sensing.</p>
UNIT-II	<p>Electromagnetic energy Introduction; Electromagnetic energy- Electromagnetic spectrum, Radiation Principal's; EMR interaction with Atmosphere- scattering, Absorption and Atmospheric Windows; EMR interaction with earth surface features- reflection, absorption, emission and transmission; Spectral response pattern- vegetation, soil, water bodies.</p>
UNIT-III	<p>Remote Sensing Platforms and Sensors Platforms – Types and their characteristics; Satellites and their characteristics – Geo-stationary and sun-synchronous; Earth Resources Satellites- LANDSAT, SPOT, IRS, IKONOS, QUICKBIRD satellite series; Meteorological satellites – INSAT, NOAA, GOES; Sensors – Types and their characteristics, Across track (whiskbroom) and Along track (pushbroom) scanning; Optical mechanical scanners – MSS, TM, LISS, WiFS, PAN; Concept of Resolution – Spatial, Spectral, Temporal , Radiometric</p>
UNIT-IV	<p>Image Interpretation Introduction; Fundamental of Visual Image Interpretation; Elements of Image Interpretation; Image Interpretation strategies; Image Interpretation keys.</p>
UNIT-V	<p>Remote Sensing Data Requirement and Ground Investigation Remote Sensing Data Products and their procurement, Ground Truth Collection – Spectral Signatures, Commonly used Ground Truth equipments - use of Radiometers, Display Forms – Computer printouts, Thematic maps</p>

BOOKS RECOMMENDED

1. Jensen, J.R. 2000, *Remote Sensing of the Environment: An Earth resource Perspective*. Prentice Hall.
2. Joseph George, 2003, *Fundamentals of remote sensing*. Universities Press
3. Lillesand, T.M., and Kieffer, R.M., 1987, *Remote Sensing and Image Interpretation*, John Wiley.
4. Sabbins, F.F., 1985, *Remote sensing Principles and interpretation*. W.H.Freeman and company
5. American society for Photogrammetry and Remote Sensing, 1999, *Remote Sensing for the Earth Sciences*, Manual of Remote Sensing, 3rd ed., vol. 3, Wiley, New York.
6. Avery, T.E., and G.L. Berlin, 1992, *Fundamentals of Remote Sensing and Airphoto Interpretation*, 5th ed., Macmillan, New York.
7. Campbell, J.B., 1996, *Introduction to Remote Sensing*, 2nd ed., Guilford, New York.
8. Curran, Paul J., (1985); *Principles of Remote Sensing*, Longman, London & New York.

9. Drury, S.A., *Images of the Earth: A Guide to Remote Sensing*, 2nd ed., Oxford University Press, Oxford.
10. Elachi, C., 1987, *Introduction to the Physics and Techniques of Remote Sensing*, Wiley, New York.
11. Jensen, J.R., (2004); *Remote Sensing of the Environment: An Earth Resource Perspective*, Pearson Education.
12. Joseph, G., 2003: *Fundamentals of Remote Sensing*, Universities Press, Hyderabad.
13. Lillesand, T. and Kiefer, R., 1999: *Remote Sensing and Image Interpretation*, Wiley, London.
14. Mather, P.M. (1999). *Computer processing of remotely sensed images: an introduction*, Wiley, Chichester.
15. Sabins, F. F., Jr., (1997): *Remote Sensing: Principles and Interpretation*, 3rd ed., W.H. Freeman, New York.
16. Star, J.L., J.E. Estes, and K.C. McGwire, 1997, *Integration of GIS and Remote Sensing*, Cambridge University Press.

Semester-I
Paper Code: RS/GIS-104
Digital Image Processing
Paper-IV

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	<p>Fundamentals of Digital Image Concept of Digital Image and Digital Image Processing; Analog versus digital image; Digital Image Data Format; Image data storage and retrieval;</p>
UNIT-II	<p>Image Rectification and Restoration Pre-Processing; Radiometric Errors and correction- Correcting remote sensing system detector error, remote sensing atmospheric correction, Geometric Errors and correction- Internal and external Geometric errors, types of geometric correction, mosaicking.</p>
UNIT-III	<p>Image Enhancement Image enhancement Techniques - an overview; Image reduction and magnification; Contrast Enhancement - Linear and non linear; Band Rationing; Spatial filtering and Edge enhancement; Density slicing; Multi image manipulation – addition, subtraction; Principal Component Analysis; Enhancement by using colours – advantages, Types of colour enhancements; BGR – coding and generation of FCC's; Image transformation-Intensity Hue Saturation (HIS)</p>
UNIT-IV	<p>Image Classification Principles of Image Classification-Image space, Feature space, Image classification; Image Classification process- Preparation for image classification, supervised image classification, unsupervised image classification, classification algorithms; Fuzzy classification; classification based on Object-oriented Image Segmentation</p>
UNIT-V	<p>Accuracy Assessment Concept of Accuracy Assessment; Source of Errors in remote sensing derived thematic products; Error Matrix; Sampling consideration; Evaluation of Error Matrices; Kappa Analysis;</p>

BOOKS RECOMMENDED

1. Jahne, B. 1991 *Digital Image Processing New York*: Springer-Verlag.
2. Jain, A.K. 1989, *Fundamentals of Digital Image Processing*, Englewood Cliffs, NJ, Prentice Hall.
3. Jonson, J.R. 1996, *Introductory Digital Image Processing*, Printice-Hall, Inc.
4. Lillsand, R.M. and R.W. Kiefer, 1999, *Remote Sensing and Image Interpretation*, 4th Ed., New York: Wiley.
5. Mathur, P.M. 1999, *Computer Processing of Remotely Sensed Images: an introduction*, Wiley, Chichester.
6. Mullar J.P. 1986, *Digital Image Processing in Remote Sensing*, Taylor & Francis.
7. Pratt, W.K., 1991, *Digital Image Processing* 2nd ed., New York Wiley.
8. Richards, J.A., 1986, *Remote Sensing Digital Image Analysis*, New York: Springer-Verlag.
9. Russ, J.C. 1992, *Image Processing Handbook*. Boca Raton, FL: CRC Press.

10. Schowengerdt, R.A., 1983, *Techniques for image processing and classification in Remote Sensing*, New York: Academic Press.

**Semester-I
PRACTICAL**

100 Marks

Practical Examination will be taken on the following topics:

1. Familiarization with ERDAS software.
2. Visualization; Import and export of satellite data to various formats.
3. Geo-referencing of data- image to image, image to maps
4. Layer Stacking of Multispectral Imagery
5. Creating subset of image.
6. Resolution merge and Mosaic.
7. Displaying individual pixel value and image information.
8. Image enhancement techniques- image contrast, histogram equalization and density slicing.
9. Band Rationing; Filtering techniques; Principal Component Analysis.
10. Classification – supervised and unsupervised.
11. Recoding of Pixels
12. Accuracy Assessment
13. Change detection.

Distribution of Marks of Practical Examination

- | | | |
|-------|------------------------|----------|
| (i) | Mid-term Lab work..... | 25 Marks |
| (ii) | Annual Lab Work..... | 25 Marks |
| (iii) | Record Book..... | 25 Marks |
| (iv) | Viva –Voice..... | 25 Marks |

Semester-II
Paper Code: RS/GIS-201
GEOGRAPHIC INFORMATION SYSTEM
Paper-I

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	Introduction and Geometric Transformation Introduction, Definition, Components and History of GIS; Data and Information, Rectification- Map to Image Rectification and Image to Image Registration; Transformation Methods; Root Mean Square (RMS) Error.
UNIT-II	Data Types and Data Models Data Types; Spatial Data; Non-Spatial Data, Data Input; Existing GIS Data, Metadata; Conversion of Existing Data, Creating New Data, Data Models; Vector Data Model; Raster Data Model; Integration and Comparison of Vector and Raster Data Models.
UNIT-III	Spatial Data Editing Types of Digitizing Errors, Locational Errors- Location Errors Using Secondary Data Source, Location Errors Using Primary Data Source, Causes for Digitizing Errors; Topological Errors- Topological Errors With Geometric Features, Topological Errors Between Layers; Topological Editing and Non topological Editing; Other Editing Operations; Editing Using Topological Rules.
UNIT-IV	Attribute Data and Data Exploration Attribute Data in GIS, Attribute Data Entry, Manipulation of Fields and Attribute Data, Data Exploration; Attribute Data Query, Raster Data Query, Map- Based Data Manipulation.
UNIT-V	Data Analysis and Techniques Raster Data Analysis-Location Operations; Neighborhood Operations, Zonal Operations, Other Raster Data Operations; Vector Data Analysis-Buffering, Overlay, Distance Measurement, Pattern Analysis, Map Manipulation.

BOOKS RECOMMENDED

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Peter .A Burroughs and McDonell, Rachel A 2. Ksang-tsung Chang 3. Nadine Schuurman 4. Dr. M.A .Siddiqui 5. Zerine Camp 6. David R.Green, Davidrix, Chris Corbin 7. Paul A. Longley, Michael F.Goodchild, David 8. J.Maguire, David W.Rhind 9. John E.Harmon & Slevan J.Anderson 10. Peter A.Burrough & Rachael A.Mcdonnell 11. John P. Wilson and A. S. Fotheringham Science | <ol style="list-style-type: none"> Principles of Geographic Information System Geographic Information System GIS A Short introduction Geographic Information System Innovation in GIS The age source book for GIS 1996 Geographic Information System and Science Introduction to mathematical Techniques Used in GIS Geographic Information Systems Principles of GIS The Handbook of Geographic Information |
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Semester-II
Paper Code: RS/GIS-202
COMPUTER CARTOGRAPHY
Paper-II

Term End Exam: 70 Marks
 Internal Assessment: 30 Marks
 Total: 100 Marks

UNIT-I	Introduction Introduction and Significance of Computer Mapping, Mapping in a Digital Age.
UNIT-II	Cartographic Communication and Visualization Introduction, Graphic Symbology, Graphic Variables, Issues in Map Design, Text Placement, Visualization of 3D data.
UNIT-III	Interactive Cartography and Geo-visualization Cartography and Information Retrieval, Public Information Access, Basics of Geovisualization, Statistical Representation in GIS; Distribution Maps, Density Maps.
UNIT-IV	Map Generalization Concepts and Definition of Map Generalization, Factors Influencing Generalization, Different operation in Generalization; Semantic Generalization; Geometric Generalization.
UNIT-V	Fuzzy Mapping Basics of Fuzzy Classification Mapping, Assigning Membership Values, Aggregation Models, Rule Based Models, Data-Driven Fuzzy Classifications, Spatial Interpolation and Classification, Visualizing Fuzzy Classifications, Issues of Cost of Fuzzy Mapping.

BOOKS RECOMMENDED

- | | |
|--|---|
| 1. Ksang-tsung Chang | Geographic Information System |
| 2. R.L Singh | Practical Geography |
| 3. Johns Christopher | Geographical Information System
And Computer Cartography |
| 4. Paul A. Longley, Michael
F. Goodchild, David | Geographic Information System and
Science |
| 5. Robinson, A.H., Morrison, | Element of Cartography |
| 6. John P. Wilson and A. S. Fotheringham Science | The Handbook of Geographic Information |

Semester-II

Paper Code: RS/GIS- 203

EARTH'S POSITIONING SYSTEMS

Paper-III

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	Introductory Introduction; History of Navigation and Positioning; Objectives, Types of Earth's Positioning System- GPS, GALILEO and GLONASS; Comparison of Main Parameters for GPS, GLONASS and GALILEO.
UNIT-II	Datum, Coordinate Systems and Map Projections Basics Geodesy, Geoid/ Datum/Ellipsoid-Definition and Basic Concepts; Datum Transformations; Map Projections.
UNIT-III	Fundamentals of Positioning Systems GPS Components – space segment, control segment, user segment; GPS Receiver and its Types -; GPS Errors. GPS Positioning Modes: GPS point positioning, GPS relative positioning; RTK GPS.
UNIT-IV	Differential Positioning System (DGPS): Components, Function and applications. Differential RTK, Differential Real Time, Wide Area Augmentation System (WAAS).
UNIT-V	Applications of GPS Route Navigation, Forestry and Natural Resources, GPS Tracking, Utility Mapping, Civil Engineering, Cadastral Surveying and Seismic Applications

BOOKS RECOMMENDED

1. Ahmed El-Rabbany
Introduction to GPS: The Global Positioning System.
2. Rolf A.de By
Principal of GIS
3. C.P.Lo Albert K.W. Yeung
Concept and Techniques of GIS
4. Michael Kennedy
The GPS and the Arc GIS
5. Mahinder S.Grewal, Lawrence R. Weill&Angus P.Andrews
GPS, Inertial Navigation and Integration
6. Nel Samama
Global Positioning System
7. James B.Cambell
Fundamental of GPS Receiver
8. B.Hofmann-Wellenhof&H. Lichtenegger & J.Collins
GPS: Theory and Practice

Semester-II
Paper Code: RS/GIS- 204
ADVANCED REMOTE SENSING
Paper-IV

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	Thermal Remote Sensing Thermal radiation principles, Thermal process and properties, Characteristics of thermal IR images and Factors affecting thermal images, Interaction of thermal radiation with terrain elements, Multispectral thermal data.
UNIT-II	Data Processing of Thermal Remote Sensing Thermal image and types of available data products, Temperature mapping with thermal scanner data, Information extraction from thermal mapping, Applications of Thermal Remote Sensing.
UNIT-III	Microwave Remote Sensing Introduction to microwave remote sensing – Concept and principle, backscattering, cross section Wavelength, incidence angle, aspect angle, aircraft radar system; Interactions between radar and surface materials - complex dielectric properties, roughness polarization, Passive & active microwave sensors, Application of microwave remote sensing and microwave image interpretation.
UNIT-IV	Radar Environmental Considerations Fundamentals of radar interferometer, Side looking airborne radar (SLAR), geometric characteristics, components, wavelengths range and azimuth resolution, Synthetics real aperture radar system, Radar image interpretation.
UNIT-V	LIDAR and its Applications Physics of laser, laser interaction with objects, LIDAR (Light Detection and Ranging)– components of LIDAR system, Applications in vegetation, urban and coastal mapping.

BOOKS RECOMMENDED

- | | |
|--|---|
| 1. Lillesand, R.M. and R.W. Kiefer, 1999,
New York: Wiley | Remote Sensing and Image Interpretation,
4 th Ed. |
| 2. Jensen J.R. (2005)
Prentice Hall. | Digital Image Processing: A Remote
Sensing Perspective, 3rd ed, |
| 3. Joseph, George, (2003),
University Press (India) Pvt.
Ltd, Orient Longman Pvt. Ltd., Hyderabad, India | Fundamental of Remote Sensing, |
| 4. Jensen J.R. (2007)
Prentice Hall | Remote Sensing of the Environment: An Earth
Resource Perspective, 2nd ed., |
| 5. Panda, B. C., 2008.
Viva Books Private Limited, India | Remote Sensing: Principles and Applications, |
| 6. Iain H. Woodhouse, CRC, 2004 | Introduction to Microwave Remote Sensing . |

Semester-II
PRACTICAL

100 Marks

Practical Examination will be taken on the following topics:

1. Spatial data Integration (Digitization) – point, line, polygon.
2. Non-Spatial Data Integration.
3. Editing of Spatial & Non-Spatial data.
4. Building Topology; Data Query.
5. Texture & Object based classification & Modeling.
6. Raster Data calculations.
7. Accuracy assessment.
8. Determination of Latitude, Longitude and height.
9. Collection of Waypoints.
10. Tracking through GPS.
11. Downloading handheld GPS data into software.
12. Mapping and editing.
13. Cartographic Symbolization, Generalization of Maps.
14. Types of Maps.
15. Map Design or Layout, Map Production.

Distribution of Marks of Practical Examination

- (i) Lab Work.....50 Marks (Time-2 hours)
- (ii) Record Book.....25 Marks
- (iii) Viva –Voice.....25 Marks

Semester-III
Paper Code: RS/GIS- 301
ADVANCED GIS
Paper-I

Term End Exam: 70 Marks
 Internal Assessment: 30 Marks
 Total: 100 Marks

UNIT-I	Database Management Systems Object Oriented Database Management Systems- GIS and Spatial Data Management System, RDBMS and SQL; Object Oriented Database Management Systems, Object Relational Database Management Systems; Spatial Decision Support System- Historical Background, Definition, Components, Technologies.
UNIT-II	GIS: Techniques and Analysis Viewshed and Watersheds Analysis- Concept of Viewshed Analysis, Parameters of Viewshed Analysis, Application Viewshed analysis; Concept of Watershed Analysis, Factors Influencing Watershed Analysis, Applications of Watershed Analysis; Network Analysis- Shortest Path Analysis; Closest Facility; Service Area; Origin- Destination Matrix.
UNIT-III	Terrain Mapping Terrain Mapping and Analysis- Digital Elevation Modeling, Triangulated Irregular Network, Contouring, Profiling, Hill shading, Slope Analysis and Aspect Analysis; Geocoding- Address Matching; Intersection Matching; Applications of Geocoding.
UNIT-IV	Recent Trends in GI Science Interoperability and Web GIS- Concept and Applications; Mobile GIS- Concepts, Portable PCs Personal digital assistance (PDAs) or Palm Top, Mobile Phone, Arc GIS Mobile, Characteristics of Mobile GIS, Benefits of Mobile GIS, Mobile Applications.
UNIT-V	Emerging Branches and Future Trends Emerging Branches of GI Science- Geo-Informatics, Hydro-Informatics, Weather-Informatics, Biodiversity-Informatics, and Socio-Informatics; Geographic Information Science and Society; Future Trends of GI Science and Challenges-Web Based GIS, Location Based Services and GIS, Volunteer GIS, Cloud GIS, GI Science Challenges.

BOOKS RECOMMENDED

- | | |
|----------------------------------|--|
| 1. John P. Wilson. el. | The Handbook of Geographic Information Science |
| 2. Paul A. Longley et. El. | GIS and Science |
| 3. Jacek Malczewski | GIS & Multicriteria decision Analysis |
| 4. Bruce Gittings | Integrating Information Infrastructures with GI technology |
| 5. Hugh E. Williams & David Lane | Web database Application |
| 6. Jane Drummond et. el. | Dynamics and Mobile GIS |
| 7. Robert A. Schowengerdt | RS-Models and methods for Image Processing |
| 8. A. Ardeshir Isohtasry | 2-D & 3-D Image registration |
| 9. Andrew Skidmore | Environmental Modeling with GIS and RS |
| 10. Jonathlan&raper | Multidimensional GI science |
| 11. Yashavant Kanethar | Let Us C |
| 12. Ivan Bayross | QL, PL/SQL |

Semester-III
Paper Code: RS/GIS- 302
WEB GIS
Paper-II

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	<p>Introduction Concepts and Principles of Web GIS; Definition and History of Web GIS; Significance of Web GIS; Internet GIS; Open Source GIS; Web Based Geo Portal.</p>
UNIT-II	<p>Elements of Web GIS The web as a source of spatial data; Maps on the Web; Querying and visualizing geographic information on the web; The Web as an integral part of GIS; Geographic Markup Language (GML); GML Features; GML Application Schema;; Visualization of GML; Development of GML Prototype.</p>
UNIT-III	<p>Architecture and Services of Web GIS Architectures for Delivering Web Services- three-tier architecture for web GIS; Interoperability and the Open-GIS Consortium- open web services framework (OSF); Web components- the browser, the server, the hypermedia document and the Uniform Resource Locator (URL); presentation and interaction with geographic information on web.</p>
UNIT-IV	<p>Web Services Web Map Services (WMS), Web Feature Services(WFS), Catalogue Service on Web (CSW), Web Registry Service (WRS), Web Coverage Service (WCS), ASP (Active Server Pages)– Introduction, scripting in ASP</p>
UNIT-V	<p>Applications of Web GIS India GeoPortal; State GeoPortal and District GeoPortal. Vehicle Tracking System, Mobile mapping, Location Based Services, Intelligent transportation systems</p>

BOOKS RECOMMENDED

1. Zhong-Ren Peng and Ming-Hsiang Tsou Internet GIS
2. Pinde Fu and Jiulin Sun Web GIS: Principles and Applications

Semester-III
Paper Code: RS/GIS- 303
Applications Remote Sensing and GIS
Paper-III

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	<p>Fundamental Remote Sensing Application in Land and Water Resources Emergence of Remote Sensing technology in application areas; Remote sensing in mapping Land use / land cover classification and monitoring; Forest resources management; Principles and approaches of crop inventory and crop production forecasting; Soil classification as per soil taxonomy; Hydrological cycle-Types of precipitation and the analysis.</p>
UNIT-II	<p>Application in Climate Change and Disaster Management Concept of climate and weather, Climatic classification, Mapping of landslide hazards, Floods, Cyclones, Forest fire and Drought.</p>
UNIT-III	<p>Principles of Urban and Rural Area Development Principles of urban/rural area development planning and land use; Urban/Rural area planning and resource development; Data requirement for Urban and Rural Planning; Large scale mapping for cadastral/RS database in urban/rural areas.</p>
UNIT-IV	<p>Urban and Rural Planning Transportation/ road network analysis through RS and GIS; Site selection and suitability analysis for rural/urban development; Urban Sprawl and change detection studies.</p>
UNIT-V	<p>Application in Environmental Management Selection of disposal sites for industrial and municipal wastes, Solid waste management, Environmental Impact Assessment (EIA) and Auditing.</p>

BOOKS RECOMMENDED

1. Schultz, G. A. and Engman, E. T. 2000. Remote Sensing in Hydrology and Water Management, Springer-Verlag, Berlin, German.
2. Lilliland, 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. Srivastava P., Pandey P.C., Kumar P., Raghubansi A.S., Han D. 2015. Geospatial Technology for Water Resource Development. CRC Press, Taylor and Francis
5. P.K. Joshi, P. Pani, S. N. Mohapartra and T.P. Singh, Ed 2010 "Geoinformatics for Natural
6. Resource Management", Nova Publishers, India
7. P.K. Joshi and T.P. Singh (2011). Geoinformatics for Climate Change Studies, TERI Press, New Delhi.
8. P. S. Roy (2000). Natural Disaster and their mitigation. Published by Indian Institute of Remote Sensing (IIRS), 2000.
9. Spatial Technologies for Natural Hazard Management. Proceedings of ISRS National Symposium, Nov. 21-22, 2000, IIT, Kharagpur.

Semester-III
Paper Code: RS/GIS- 304
Research Methodology and Project Management
Paper-IV

Term End Exam: 70 Marks

Internal Assessment: 30 Marks

Total: 100 Marks

UNIT-I	<p>Fundamentals of Research Brief description of research; Thomson Reuters Journal Citation Report (JCR); Scopus data base; h-index; i10-index; Impact Factor; Eigen factor™ Score; Article Influence™ Score; ISSN</p>
UNIT-II	<p>Basic Concept of Research Methodology Objectives of research; Types of research; Significance of research; Definition of research problem, Technique involved in defining a problem; Identification of problems of regional and local level.</p>
UNIT-III	<p>Research and Sampling Design Meaning of Research Design ; Basic Principles of Experimental Designs; Important Concepts Relating to Research Design; Implications of a sample design; Basic step of sample design; Type of sample design.</p>
UNIT-IV	<p>Data Collection Collection of primary data; collection of secondary data; Types of data collection; Advantage and limitation of case study; Reporting of results, References.</p>
UNIT-V	<p>Research Project Proposal and Report Writing Writing of proposals, Objectives of project, Research questions, Scope of project, Brain storming sessions, Review of similar studies and present level of research, Time scheduling (PERT), Financial estimates, Submission of proposal; Significance of Report Writing; Mechanics of Writing a Research Report.</p>

BOOKS RECOMMENDED

1. W.E. Huxold & A.G. Lerinsons Aronoft.S.(1989) Managing Geographic Information Projects
2. CR Kothari, 2004, "Research Methodology Methods and Technique, New Age International Pvt Ltd. New Delhi
3. S L Gupta and Hitesh Gupta, 2011 "Research Methodology Text and Cases with SPSS Applications, International book House Pvt Ltd., New Delhi.
5. Earickson, R., and Harlin, J. (1994) Geographic Measurement & Quantitative Analysis Macmillan, N.York.
6. Bennet P. Lientz & Kathryn P. (1995) Project Management for the 21st Century Academic Press, California

Minor Project Work

100 Marks

1. Minor Project Evaluation25
2. Minor Project Presentation.....25
3. Minor Project Viva Voice.....50

SEMESTER –IV
M.Sc. Remote Sensing and GIS
PROJECT ORIENTED DISSERTATION

500 Marks

1. Synopsis Outline100
2. Dissertation Evaluation (External Examiner).....100
3. Dissertation Evaluation (Internal Examiner).....100
4. Project Presentation.....100
5. Project Viva Voice.....100