# UNIVERSITY OF PUNE
# DEPARTMENT OF GEOGRAPHY

## Credit System (M.Sc. Geoinformatics): Details of the Courses and Credits – 2018

| **SEMESTER I** | | | | |
|---|---|---|---|---|
| **Core Courses** | | | | |
| **Subject Code** | **Subject Title** | **Credits Per Subject** | **Credits To Be Completed** | |
| | | | **Subject-Wise** | **Semester-Wise** |
| GE 101 | Introduction to Remote Sensing | 4 | 4 | |
| GE 102 | Introduction to Geographic Information System | 3 | 3 | |
| GE 103 | Spatial Data Processing | 4 | 4 | |
| GE 104 | Aerial Photo and Image Interpretation | 3 | 3 | |
| GE 105 | Methods of Data representation | 3 | 3 | |
| | Concepts in Geography (Non-credit course) | | | |
| **Elective Courses** | | | | |
| **Subject Code** | **Subject Title** | **Credits Per Subject** | **Credits To Be Completed** | |
| | | | **Subject-Wise** | **Semester-Wise** |
| | **Any one of the following courses** | | | |
| GE 106 | Programming in 'C' | 3 | 3 | |
| GE 107 | Topographical Map Interpretation | 3 | 3 | |
| | **Total credits in semester I** | **20** | **20** | **20** |
| **SEMESTER II** | | | | |
| **Core Courses** | | | | |
| **Subject Code** | **Subject Title** | **Credits Per Subject** | **Credits To Be Completed** | |
| | | | **Subject-Wise** | **Semester-Wise** |
| GE 201 | Digital Image Processing: Theory | 3 | 3 | |
| GE 202 | Spatial Analysis: Theory | 3 | 3 | |
| GE 203 | Digital Image Processing: Practical | 4 | 4 | |
| GE 204 | Spatial Analysis: Practical | 4 | 4 | |

| **Elective Courses** | | | | |
|---|---|---|---|---|
| **Subject Code** | **Subject Title** | **Credits Per Subject** | **Credits To Be Completed** | |
| | | | **Subject-Wise** | **Semester-Wise** |
| | **Any one of the following courses** | | | |
| GE 205 | Statistical Methods | 3 | 3 | |
| GE 206 | Cartographic Techniques | 3 | 3 | |
| | **Any one of the following courses** | | | |
| GE 207 | Advanced Surveying: Concepts and Methods | 3 | 3 | |
| GE 208 | Programming in C++ | 3 | 3 | |
| | **Total credits in semester II** | **20** | **20** | **20** |
| **SEMESTER III** | | | | |
| **Core Courses** | | | | |
| **Subject Code** | **Subject Title** | **Credits Per Subject** | **Credits To Be Completed** | |
| | | | **Subject-Wise** | **Semester-Wise** |
| GE 301 | Advances in Remote Sensing | 3 | 3 | |
| GE 302 | Advances in GIS | 3 | 3 | |
| GE 303 | Advance in Spatial Data Processing: Practical | 4 | 4 | |
| GE 304 | Database Management System: Concepts and Methods | 4 | 4 | |
| **Elective Courses** | | | | |
| **Subject Code** | **Subject Title** | **Credits Per Subject** | **Credits To Be Completed** | |
| | | | **Subject-Wise** | **Semester-Wise** |
| | **Any one of the following courses** | | | |
| GE 305 | Application of GIS and RS Techniques – I | 3 | 3 | |
| GE 306 | Programming in .NET | 3 | 3 | |
| | **Any one of the following courses** | | | |
| GE 307 | Programming in Python | 3 | 3 | |
| GE 308 | Open Source GIS and Web GIS | 3 | 3 | |
| | **Total credits in the semester III** | **20** | **20** | **20** |
| **SEMESTER IV** | | | | |
| **Core Courses** | | | | |
| **Subject Code** | **Subject Title** | **Credits Per Subject** | **Credits To Be Completed** | |
| | | | **Subject-Wise** | **Semester-Wise** |
| GE 401 | Research Methodology and Project Management | 5 | 5 | |
| GE 404 | Project Work | 10 | 10 | |

| **Elective Courses** | | | | |
|---|---|---|---|---|
| **Subject Code** | **Subject Title** | **Credits Per Subject** | **Credits To Be Completed** | |
| | | | **Subject-Wise** | **Semester-Wise** |
| | **Any one of the following courses** | | | |
| GE 402 | Programming in HTML, JAVA Scripting | 5 | 5 | |
| GE 403 | Application of GIS and RS Techniques– II | 5 | 5 | |
| | **Total credits in the semester IV** | **20** | **20** | **20** |

## Semester I

| **Code: GE101** | **Introduction to Remote Sensing** | |
|---|---|---|
| **No. of Credits: 4** | | **No. of Lectures: 60** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Introduction to Remote Sensing: Concepts Definition, History Development, Stages in RS-EMR, EMR Spectrum, Theories of EMR, Types of RS and Laws of Radiation | 15 |
| 2 | Interaction of EMR: Interaction with Earth's Atmosphere | 10 |
| 3 | Spectral Signature: Interaction with Soil, Water and Vegetation | 05 |
| 4 | Platforms, Sensors, Orbits: Types of Platform, Types of Sensors, Cameras and Satellite Orbits | 15 |
| 5 | Aerial Photography: Introduction to Aerial Photography and Basic Photogrammetry | 10 |
| 6 | Data Products: Satellite Data Generation, Formats and Aerial Photography Products | 5 |

Books:


1. Joseph, G. (2004): Fundamentals of Remote Sensing, Universities Press, Hyderabad, India
2. Lillesand, T. M., Kiefer, R. W. andChipman, J. W.(2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
3. Sabins, F. F. (1996): Remote Sensing: Principles andInterpretation, W.H. Freeman and Company, San Francisco
4. Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
5. Drury, S. A. (2001): Image Interpretation in Geology, Blackwell, Oxford
6. Campbell, J. (2002): Introduction to Remote Sensing, Taylor & Francis, London
7. Anji Reddy, M. (2008): Textbook of Remote Sensing and Geographic Information System, B.S. Publication, Hyderabad

| **Code: GE102 Introduction to Geographic Information System** | | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Introduction to GIS: Definitions, Evolution, Components and Objectives | 3 |
| 2 | Hardware & Software Requirements: Hardware: Basic Blocks of Computer, Processor, Memory, Secondary Storage Devices, Input/Output Devices, Binary Numbers. Software: Operating System, Application, Compliers, Editors. Overview of GIS Software Packages | 2 |
| 3 | Spatial Data: Types of Geographic Data, Levels of Measurements. Concepts of Space and Time, Layers Coverage. Spatial Data Models, Representation of Geographic Features in Vector, Raster Data Models. Concept of Arc, Node, Vertices and Topology. Object Oriented Models: Advantages and Disadvantages. Computer Representation for Storing Spatial Data: Block Code, Run-Length Encoding, Chain Coding, Quadtree. Issues Governing Choice of Models. | 13 |
| 4 | Non-Spatial Data: Advantages of Data Base Management System. Conceptual Implementation Models, Hierarchical, Network, Relational Models. RDBMS: Components, Concept, Database Schema, Tables and Relationships. Database Design Normalization (1NF, 2NF, 3NF Forms) Data Definition Manipulation using SQL, SQL-Query Processing, Operations on Tables, Integrity Constraints, Database Security,Role of Database Administrator (DBA). Metadata | 12 |
| 5 | Spatial Data Input: Digitization, Error Identification. Errors: Types, Sources, Correction.Editing and Topology Building | 5 |
| 6 | Concepts of GPS: History, Types, Navigation Systems and Applications | 10 |

Books:


1. Longley, P. A., Goodchild, M. F., Maguire, D. J.,Rhind, D. W. (2002):Geographical Information Systems and Science, John Wiley & Sons, Chichester
2. Lo, C. P.,Yeung, A. W.(2002): ConceptsTechniques of Geographical Information Systems, Prentice-Hall of India, New Delhi
3. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
4. Korte, G. B.(2001):The GIS Book, Onward Press, Bangalore
5. Demers, M. N.(2000):Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi
6. Burrough, P. A. and McDonnell, R.A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
7. Heywood, I., Cornelisus, S., Carver, S. (2011):An Introduction to Geographical Information Systems,Pearson Education, New Delhi
8. Ahmed, E. L. Rabbany(2002): Introduction to Global Positioning Systems, ArtechHouse, Boston

| **Code: GE: 103** | **Spatial Data Processing** | |
|---|---|---|
| **No. of Credits: 4** | | **No. of Practicals: 15** |
| **Sr. No.** | **Topic** | **Practicals** |
| 1 | Overview of Arcgis: Arcmap, Arccatalog and Arctool Box | 2 |
| 2 | Attribute Data Input: Creation Of Schema, Tables, Data Definition, Data Input, Data Updating, Queries on Tables, Simple-Complex Query With Two or More Tables Using SQL. Queries Using Union, Intersection, Join Etc Operations. Use of MS-Excel and MS Access | 5 |
| 3 | Spatial Data Input: Vector Data Formats With File Extensions. Scanning, On-Screen Digitization, Editing, Topology Creation, Line and Area Measurements, Data Attribution | 5 |
| 4 | GPS: GPS Survey, Data Import, Processing and Mapping | 3 |

Note: a) For 4 credits 4 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Books:


1. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
2. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The ARC/INFO Method, ESRI Press, Redland
3. Ahmed, E. L., Rabbany (2002): Introduction to Global Positioning System, Artech House, Boston
4. Kresse, W. and Danko, D. (2002): Springer Handbook of Geographic Information, Springer Drecht, London
5. Bao, J., Tsui, Y. (2005): Fundamentals of Global Positioning System Receivers, John Wiley Sons, Inc., Hoboken.

| **Code: GE104** | **Aerial Photo and Image Interpretation** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Practicals: 15** |
| **Sr. No.** | **Topic** | **Practicals** |
| 1 | Measurements: Geometry of Aerial Photographs, Determination of Scale, Height on Aerial Photograph | 4 |
| 2 | Aerial Photo and Image Interpretation: Interpretation of Aerial Photos: Single, Vertical Stereo Pairs. Interpretation of Satellite Imagery: Derived From PAN, LISS, Wifs, OCM Sensors. Study and Visual Interpretation of Satellite Images for Physical Features, Urban, Forest and Agricultural Uses | 5 |
| 3 | Introduction to Digital Photogrammetry: Concepts and Techniques of Digital Photogrammetry | 4 |
| 4 | Field Work: Study Tour: Identification of Features in the Field Using Aerial Photographs and/or Satellite Images | 2 |

Note: a) For 3 credits 3 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Books:


1. Lillesand, T. M., Kiefer, R.W. andChipman, J. W.(2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
2. Joseph, G. (2004): Fundamentals of Remote Sensing, Universities Press, Hyderabad, India
3. Agarwal, C. S. Garg, P. K. (2000): Remote Sensing, Wheeler A. H., New Delhi
4. Drury, S. A. (2001): Image Interpretation in Geology, Blackwell, Oxford
5. Wolf, P.R. (1974): Elements of Photogrammetry, McGraw Hill Inc.,Kogaknscha

| **Code: GE105** | **Methods of Data Representation** | |
|---|---|---|
| **No. of Credits: 03** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Data and Data Types: Nominal.Ordinal,Interval,Ratio<br>Representation of Statistical data: Choropleths, Isopleths, Dots<br>Unimodal, Two-Dimensional and Three Dimensional Diagrams | 10 |
| 2 | Map Generalization: Recent Development in Map Visualization, Animation, Multimedia, Interactive Map | 5 |
| 3 | Representation of Natural Features: Profiles, Identification and Representation of Different. Natural Features like Fluvial, Coastal, Aeolian and Glacial Landforms | 20 |
| 4 | Representation of Different Manmade Features: Settlement, Transportation, Landuse | 10 |

Books:


1. Singh, R. L.(1979): Elements of Practical Geography, KalyaniPublishers,New Delhi
2. Croxton, F. E., Cowden, D. J., Klein, S. (1975): Applied General Statistics, Prentice-Hall of India, New Delhi
3. Frank, H. Althoen, S. C.(1994): Statistics Concepts and Applications, Cambridge University Press
4. Yeates, M.(1974): An Introduction to Quantitative Analysis in Human Geography, McGraw-Hill, New York

| **Code: GE106** | **Programming in 'C'** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Practicals: 15** |
| **Sr. No.** | **Topic** | **Practicals** |
| 1 | Computer Fundamentals: Characteristics and Limitations, Computer Architecture: Computer Block Diagram, Flow Chart, Operating System, Data Storages. Networking: LAN, MAN, WAN, Various Topologies like Ring, Bus, Star, Networking Devices like Hub, Repeaters, Switch, Bridge, Router.<br>Web Concepts: OSI Model, URL, Ports, Firewall, DNS, IP Address, Proxy, Session, Cookies.<br>Client and Server Architecture: Various Protocols like Http, Https, FTP, SMTP, POP3<br>Distributed Computing: Introduction to Distributed Networking and Cloud Computing | 5 |
| 2 | C Language: Introduction to C: History of Programming Language, Importance of Computer Languages, Understanding Compiler.<br>Input /Output Functions: Console Input Output, Formatted Input Output.<br>Data Types and Operators: Types and Uses of Various Operators.<br>Control Structures: Various Looping Mechanism, Types of Loops.<br>Introduction to Array: Understanding Array, Working with Single Multidimensional Array. Limitations of Array, Structure Unions.<br>Introduction to Functions: Need of Function, Defining, Calling Function, Different Types of Functions. Understanding of Pointer.<br>File Handling: Reading and Writing the Data to File | 10 |

Note: a) For 3 credits 3 hours practical per week.
b) The concerned teacher may add some points related to the subject

Books:

1. Kernighan, R. (1998): C Programming Language, (ANSI C Version), Prentice Hall, New Jersey
2. Balagurusamy, E. (2002): Programming in ANSI C, Tata McGraw Hill, New Delhi
3. Kanetkar, Y. (2001): Let Us C, BPB Publications, New Delhi

| **Code: GE 107 Topographical Map Interpretation** | | |
|---|---|---|
| **No. of Credits: 03** | | **No. of Practicals: 15** |
| **Sr. No.** | **Topic** | **Practicals** |
| 1 | Introduction to Survey of India Topographical Maps | 3 |
| 2 | Numbering, Scales, Grid Reference, Signs and Symbols, Color System | 5 |
| 3 | Interpretation of Maps: Study and Interpretation: SOI Toposheet, Cadastral and Thematic Maps | 7 |

Note: a) For 3 credits 3 hours practical per week.
b) The concerned teacher may add some points related to the subject

Books:


1. Singh, R. L.(1979): Elements of Practical Geography, KalyaniPublishers,New Delhi
2. Tamaskar, B. G.,Deshmukh, V. M. (1974): Geographical Interpretation of Indian Topographical Maps, Orient Longman Ltd., Bombay
3. Croxton, F. E., Cowden, D. J., Klein, S. (1975): Applied General Statistics, Prentice-Hall of India, New Delhi
4. Frank, H. Althoen, S. C.(1994): Statistics Concepts and Applications, Cambridge University Press
5. Robinson, A. H., Morrison, J. L., Muehrcke, P. C., Kimerling, A. J. Guptill, S. C. (1995): Elements of Cartography, Wiley, New York
6. Yeates, M.(1974): An Introduction to Quantitative Analysis in Human Geography, McGraw-Hill, New York
7. Ramamurthy, K. (1982): Map Interpretation, Rex Printers, Madras
8. Vaidyanadhan, R.(1968): Index to a set of sixty Topographic Maps:IllustratingSpecifiedPhysiographic Features from India, Council of Scientific and Industrial Research, Ministry of Education, Government of India
9. Gupta, K. K. Tyagi, (1992): Working with maps, Survey of India Publication, DST, New Delhi
10. Understanding Map Projection (2003-2004): GIS by ESRI, Redlands

| **Code No: GE: Concepts of Geography** | | |
|---|---|---|
| **No. of Credits: Non- credits course** | | **No. of Lectures: 8** |
| **Sr. No.** | **Topics** | **Lectures** |
| 1 | Introduction: Geography As a Discipline: Nature and Scope | 2 |
| 2 | Natural Resources: Nature and Distribution of Biotic and Abiotic Resources | 2 |
| 3 | Human Resources: Quantitative and Qualitative | 2 |
| 4 | Sustainable Development:Resources and Development With Special Reference to India | 2 |

Books:


1. Elements of Cartography, Sixth Edition by Robinson A. H. Morrison J. L., Muehacke P.C., Published By John Wiley & sons, 1995.
2. A Complete Course of Certificate Geography, Part I by Nigam V. N., Published by pitambat Publication Comp., 1983
3. Geographical Interpretation of Indian Topographical Maps by Tamaskar B. G., Deshmukh V. M., Orient Longman Ltd, 1974
4. John R. Weeks (1999) : Population- An Introduction to Concepts and Issues, Wadsworth Pub. Co. Ca USA.
5. Knowled R. and Wareing J. (1998): 'Economic and Social Geography', Rupa and Co., N. Delhi
6. Sundaram, K. P. and Dutta, Rudra (2001), Indian Economy.
7. Population Reference Bureau:' World Population data Sheet, 2000', Washington DC.
8. Hudson, R. S. (1970):'A Geography of Settlements', McDonald and Sons, London.
9. Chisholm, M. (1962):' Rural Settlements and Landuse' London.
10. Short, John R. (1984) : ' An Introduction to Urban Geography', Routledge and Regan Paul, London

## Semester II

| **Code: GE201** | **Digital Image Processing: Theory** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Introduction to Digital Image Processing: Digital Images: Types Sources of Errors: Atmospheric, Radiometric and Geometric.<br>Image Rectification: Geometric Correction, Radiometric Correction, Noise Removal | 15 |
| 2 | Image Enhancement Techniques: Contrast Enhancement: Linear, Non-Linear, Logarithmic and Exponential, Gaussian Stretch, Density Slicing.<br>Spatial Filtering: Low Frequency, High Frequency, Edge Enhancement, Band Rationing and Band Combination | 15 |
| 3 | Digital Image Classification:<br>Classification Scheme:<br>Supervised Classification: Training Sites Selection and Statistical Information Extraction, Discriminate Functions.<br>Classifier:Maximum Likelihood, Euclidian Distance, Mahalanobis Distance, Paralellopiped.<br>Unsupervised Classification.<br>Classification Accuracy Assessment and Error Matrix | 15 |

Books:


1. Richards, J. A, Jia,X.(1999):Remote Sensing and Digital Image Processing, Springer, Verlag Berlin
2. Cha, B., Dattaa, D., Majumdar (2001): Digital Image Processing Analysis, Prentice-Hall of India, New Delhi
3. Nag, P. Kudrat, M. (1998): Digital Remote Sensing, Concept Publishing Company, New Delhi
4. Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall,NewJersey
5. Lillesand, T. M., Kiefer, R. W.Chipman, J. W.(2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
6. Sabins, F. F. (1996): Remote Sensing: Principles an Interpretation, W. H. Freeman Company, New York

| **Code: GE202** | **Spatial Analysis: Theory** | |
|---|---|---|
| **No. of Credits:3** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Introduction to Spatial Analysis: Significance of Spatial Analysis. Overview of Tools for Analysis | 2 |
| 2 | Spatial Analysis – Vector Based: Overlay Operations: Point-in-Polygon, Line-in-Polygon, Polygon-in-Polygon.<br>Single Layer Operations: Feature Identification, Extraction, Classification Manipulation.<br>Multilayer Operation: Union, Intersection, Symmetrical Difference, Update, Merge, Append and Dissolve | 5 |
| 3 | Spatial Analysis – Raster Based: Map Algebra, Grid Based Operations, Local, Focal, Zonal and Global Functions, Cost Surface Analysis, Optimal Path and Proximity Search | 5 |
| 4 | Network Analysis: Concepts, Evaluation of Network Complexity Using Alpha-Gamma Indices. C-Matrices for Evaluating Connectivity of the Network. Network Data Model. Path Analysis. Linear Referencing and Segmentation.<br>Types of Network Analysis: Optimum Cyclic Path, Vehicle Routing, Path Determination and Cost-Path Analysis.<br>Geocoding | 8 |
| 5 | Point Pattern Analysis: Methods for Evaluating Point Patterns: Clustered and Random Distribution | 5 |
| 6 | Surface Analysis: Interpolation Methods: Trend Surface Analysis, IDW, Kriging, Measures of Arrangement and Dispersion, Autocorrelation, Semi-Variogram, DEM, TIN, Slope, Aspect, Hill Shadeandview Shed | 10 |
| 7 | Spatial Modeling: Role of Spatial Model, Explanative, Predictive and Normative Models.<br>Correlation-Regression Analysis in Model Building.<br>Handling Complex Spatial Queryandcase Studies | 10 |

Books:


1. Demers, M. N.(2000):Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi
2. Burrough, P. A. and McDonnell, R.A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
3. Makrewski, J. (1999):GIS Multi-criteria Analysis, John Wiley and Sons, New York
4. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
5. Longley, P. A., Goodchild, M. F., Maguire, D. J. Rhind, D. W. (2002):Geographical Information Systems and Science, John Wiley & Sons, Chichester
6. Lo, C. P.Yeung, A. W.(2002): ConceptsTechniques of Geographical Information Systems, Prentice-Hall of India, New Delhi

| **Code: GE203** | **Digital Image Processing: Practicals** | |
|---|---|---|
| **No. of Credits: 4** | | **No. of Practicals: 15** |
| **Sr. No.** | **Topic** | **Practicals** |
| 1 | Familiarization with Image Processing System: Loading of Image Data, Identification of Objects on Visual Display, Study of Histograms and Layer Information | 1 |
| 2 | Familiarization with Image Processing System: Loading of Image Data, Identification of Objects on Visual Display, Study of Histograms and Layer Information. | 3 |
| 3 | Image Enhancement Techniques: Linear and Non- Linear Contrast Enhancement, Band Rationing, Edge Enhancement, High and Low Pass Filtering, Density Slicing | 3 |
| 4 | Image Registration: Registration of Bases Map/ Topomap, Image to Map, Image to Image | 3 |
| 5 | Image Classification: Classification : Supervised, Unsupervised and Use of Different Algorithms, Change Detection | 2 |
| 6 | Accuracy Analysis: Producer, User Accuracy, Overall and Mapping Accuracy, Kappa Coefficient | 1 |
| 7 | Vector Layers: Generation of Vector Layer, Editing and Topology Building, Area and Perimeter Estimation | 1 |
| **8** | Presentation: Map Composition | 1 |

Note: a) For 4 credits 4 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Books:

1. ERDAS (2010): ERDAS field Guide, ERDAS incorporation, Norcross, GA, USA
2. http://geospatial.intergraph.com/Libraries/Tech_Docs/Erdas_Field_Guide.sflb.ashx
3. Gupta, R. P. (2003): Remote Sensing Geology, Springer,Verlag Berlin

| **Code: GE204 Spatial Analysis: Practicals** | | |
|---|---|---|
| **No. of Credits: 4** | | **No. of Practicals:15** |
| **Sr. No.** | **Topic** | **Practicals** |
| 1 | Geodatabase in Arccatalog And Arcmap: Feature Dataset, Feature Classes, Import of Data, Spatial Data Formats, Shape/Coverage Files and Layers, Data Frames, Maps, Managing TOC | 2 |
| 2 | Georeferencing Data: Coordinate Systems, Datum Conversions, Map Projections, Types, Storing- Viewing Projection Information | 2 |
| 3 | Working with Layers in Arcmap: Building Templates, Classification, Displaying Qualitative and quantitative Values, Labeling Features and Map Creation. | 2 |
| 4 | Editing Data: Selecting Features, Simple Editing Functions, Creating New Features, Modifying, Schema Changes | 1 |
| 5 | Spatial And Non-Spatial Data: Spatial: Linking Features Attributes, Ways to View Data, Metadata<br>Non-Spatial : Understanding Tables, Field Types, Table Manipulations, Table Relationship, Joins, Relates, Creation of Graphs and Reports | 3 |
| 6 | Spatial Analysis: Query By Attribute and Location, Identifying Spatial and Non-Spatial Data, Geoprocessing Wizard, Spatial Analysis Functions, Multi Criteria Analysis using Boolean Logic | 3 |
| 7 | Network Analysis: Network Utility, Creating Network Model, Shortest Path, Geocoding | 1 |
| 8 | Presenting Data: Map Design, Map Composition | 1 |
| 9 | Project Work | * |

Note: a) For 4 credits 4 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Books:


1. Mitchell, A. (1999):The ESRI guide to GIS analysis, Redlands
2. Zeiler, M. (1999):The ESRI guide to Geodatabase design, Redlands
3. ESRI (2003): Introduction to ArcGIS- I, Course Lectures,GIS Education Solutions
4. Booth, B., Shaner, J., MacDonald, A., Sanchez, P. Pfaff, R. (2004):ArcGIS,Geodatabase Workbook, Redlands
5. Melania, H. M., Rhonda, P., Minami, M., Hatakeyama, A. M. (2004): ArcGIS, Using ArcMap, ESRI Press, Redlands
6. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The Arc/Info Method, ESRI Press, Redlands.

| **Code: GE205** | **Statistical Methods** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Geographic Data: Sources, Types, Discrete and Continuous Series, Scales of Measurements, Population, Sample and Sampling Techniques | 5 |
| 2 | Organization of Data: Frequency Distribution, Moments of Distribution, Measures of Central Tendency, Dispersion and Kurtosis | 10 |
| 3 | Matrices: Matrix Algebra: Types and Properties of Matrices. Addition, Subtraction, Multiplication and Inverse | 10 |
| 4 | Correlation and Regression:<br>Correlation: Concepts and Methods<br>Regression: Bi-Variate, Linear, Exponential, Logarithmic, Power-Law. | 15 |
| 5 | Probability: Normal, Binomial and Poisson | 5 |

Books:


1. Hammond, R. and McCullagh, P.(1991):Quantitative Techniques in Geography,ClarendonPress,Oxford
2. Gregory, S.(1978):Statistical Methods for Geographers, Longman, London
3. Frank, H. andAlthoen, S.C. (1994): Statistics: Concepts Applications, Cambridge University Press, Cambridge
4. Ebdon, D. (1977): Statistics in Geography, Basil Blackwell, Oxford
5. Rogerson, P.A.(2010): Statistical Methods for Geography, Sage Publications, London

| **Code: GE206** | **Cartographic Techniques** | |
|---|---|---|
| **No. of Credits: 03** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Map Scale: Types and Conversion | 15 |
| 2 | Vertical Exaggeration, Enlargement and Reduction | 10 |
| 3 | Map Projection: Concept, Classification, Uses<br>Types: Polyconic Projection; Mercator Projection(UTM) | 20 |

Books:


1. Elements of Practical Geography by R. L Singh, Published by Kalyani Publishers, 1979
2. Applied General Statistics by Croxton F. E., Cowden, D. J. and Klein, S. Pretice- Hall ofIndia 1975.
3. Frank, H. and Althoen, S.C., statistics Cocepts and Applications, Cambridge UniversityPress, 1994.
4. Understanding Map Projection, GIS by ESRI, 2003-2004, USA

| **Code: GE207 Advanced Surveying: Concepts and Methods** | | |
|---|---|---|
| **No. of Credits: 03** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Introduction to Total Station: Principle and Function | 5 |
| 2 | Use of Total Station in Topographical Survey, Application of Total Station in Various Fields | 10 |
| 3 | Introduction to Differential GPS (dGPS) and UAV: Principle and Functions | 10 |
| 4 | Use of dGPS in Topographical Survey. | 10 |
| 5 | Application of dGPS Points in DEM Generation from Stereo Images. | 10 |

Books:


1. Jeff, H. (1995): Differential GPS Explained, Trimble Navigation
2. Satheesh, G., Sathikumar, R. and Madhu, N. (2007): Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education, Delhi
3. Mohinder, S. G., Lawrence, R. W. and Angus, P. A. (2001): Global Positioning Systems, Inertial Navigation and Integration, John Wiley and Sons Inc., New York
4. Lawrence, L. and Alex, L. (2008): GPS Made Easy: Using Global Positioning Systems in the Outdoors, Rocky Mountain Books, Calgary
5. Stinespring, B. M. (2000): The Experimental Evaluation of a DGPS Based Navigational System for the ARIES AUV, Monterey, California: Naval Postgraduate School; Springfield

| **Code: GE208** | **Programming in C++** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Practicals: 15** |
| **Sr. No.** | **Topic** | **Practicals** |
| 1 | Introduction to OOP; Classes and Objects**:** Importance of OOP Understanding Classes, Objects, Methods and Properties. Characteristic of OOP: Abstraction, Inheritance, Polymorphism, Encapsulation. OOP and POP: Difference Between OOP and POP Constructors and Destructors: Creating Classes and Objects. Memory Allocation of Objects. Heap and Stack Memory. Managing Input /Output File Handling: C++ Stream Classes, Formatted I/O Manipulators | 7 |
| 2 | Access Modifiers, Functions and Operators: Modifying Access of Classes, Methods using Public, Private Keywords. Functions and Operators: Function Overloading and Overriding, Operator Precedence, Operator Overloading, Friend and Virtual Function. | 8 |

Note: a) For 3 credits 3 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Books:

1. Balagurusamy, E. (2006): Object Oriented Programming with C++, Tata McGraw Hill, New Delhi
2. Kanetkar, Y. (2000): Let US C++, BPB publications, New Delhi

## Semester III

| **Code: GE301** | **Advances in Remote Sensing** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Advance Techniques of Digital Image Processing: Principal Component Analysis, Fourier Transformation, IHS, Texture, Sub-Pixel, and Image Fusion, Image Segmentation | 5 |
| 2 | Thermal Imaging System: Concept, IR Region of the EMR, Atmospheric Transmission, Thermal Properties of Materials. Characteristics and Advantages of IR Images | 10 |
| 3 | Digital Photogrammetry: Concept and Techniques, Data Generation and Research Application of Cartosat-1 Data | 8 |
| 4 | Microwave, Hyperspectral Remote Sensing: Concept, Sensors, Radar Operating Principles, Synthetic Aperture Radar, INSAR and POLSAR and Radar Interferometry Radar, Image Characteristics. Concept of Hyperspectral Remote Sensing, Sensors, Multispectral Vs. Hyperspectral | 15 |
| 5 | Lidar: Concepts, Lidar Sensor System, Accuracy of Lidar Measurements | 7 |

Books:


1. Richards, J. A., Jia, X.(2000):Remote Sensing and Digital Image Processing, Springer,Verlag Berlin
2. Chand, B., Majumdar, D. D. (2001): Digital Image Processing AnalysisPrentice- Hall of India, New Delhi
3. Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
4. Lillesand, T. M., Kiefer, R. W.,Chipman, J. W.(2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
5. .Sabins, F. F. (1996): Remote Sensing: Principles Interpretation, W.H. Freeman Company, New York
6. Navalgund, R. R. Ray, S. S. (2011): Hyperspectral Data, Analysis Techniques Application, Indian Society of Remote Sensing, Dehradun

| **Code: GE302** | **Advances in GIS** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Spatial Data Mining: Methods for Knowledge discovery Spatial in Databases, Methods of Clustering, Exploring, Spatial Association, Mining in Raster Database | 7 |
| 2 | Customization of Geoinformation: Customization: Process, Uses and advantages. National Spatial Database Infrastructure | 2 |
| 3 | Spatial Decision: Analysis and Fuzzy Logic<br>Multi-Criteria Decision Analysis, Estimation of Weights. Fuzzy Logic, Operations On Fuzzy Sets, Fuzzy Vs. Boolean, Basic Rules for Inference Artificial Neural Network | 15 |
| 4 | Decision Support Systems: Types of Problems, Efficiency Effectiveness of Decision Making, Architecture of DSS Tools, Significance of DSS<br>DSS Experts Systems | 2 |
| 5 | Recent Trend in GIS: History of Network Technology, Interoperability Specifications, Cloud Computing, Crowd Sourcing and Mobile GIS, Open Source GIS | 7 |
| 6 | ArcGIS Server ArcSDE: Arcgis Server and Architecture, Web Application Functionality, GIS Web Service.<br>ArcSDE: Introduction, SDE Connection, Configuration Options.SDE for Developers Data Storage: SDE Geodatabase. ArcSDE Architecture | 10 |

Books:


1. Demers, M.N.(2000):Fundamentals of Geographic Information Systems, John Wiley& Sons, New Delhi
2. Burrough, P. A. and McDonnell, R. A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
3. Malczewski, J. (1999): GIS Multi-criteria Analysis,John Wiley &Sons,New York
4. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
5. Williams, J. (1995): Geographic Information from Space: Processing Applications of Geocoded Satellite Images, John &Wiley Sons, New Delhi
6. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The ARC/INFO Method, ESRI Press, Redlands

| **Code: GE303** | **Advance in Spatial Data Processing** | |
|---|---|---|
| **No. of Credits: 4** | | **No. of Practicals: 15** |
| **Sr. No.** | **Topic** | **Practicals** |
| 1 | Advanced Image Enhancement Techniques: Principal Component Analysis, Fourier Transformation, IHS, Texture and Image Fusion | 3 |
| 2 | Interpretation of Images: Visual Interpretation of Thermal, Radar and Hyperspectral Images | 3 |
| 3 | Ground Radiometry: Principle Working of Ground Radiometer, Data Collection, Data Integration and Analysis | 2 |
| 4 | Advance Spatial Analysis: Multi-Criteria Analysis in Arcgis Using Fuzzy Logic.<br>Classification: Fuzzy, Decision Tree | 4 |
| 5 | Customization: Customizing Arcgis Interface | 1 |
| 6 | Application: Case Studies | 2 |

Note: a) For 4 credits 4 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Books:

1. ESRI (2003):Introduction to ArcGIS – II, Course Lectures, GIS Education Solutions, Redlands
2. Bratt, S., Booth, B.(2004): ArcGIS, Using 3D Analyst, ESRI Press, Redlands
3. McCoy, J., Johnston, K., Kopp, S., Borup, B., Willison, J., Payne, B.(2002): ArcGIS, Using Arc GIS Spatial Analyst, Redlands
4. Hodson, T. Clark, K. (2003): Using ArcGIS Spatial Analyst, Redlands
5. Environmental Systems Research Institute, InC.(1998) Understanding GIS: The ARC/INFO Method, ESRI Press, Redlands

| **Code: GE304 Database Management System: Concepts and Methods** | | |
|---|---|---|
| **No. of Credits: 4** | | **No. of Lectures: 60** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Introduction: DBMS, RDBMS, SQL Database Security Concept and Advantages of RDBMS and ER Modeling. | 5 |
| 2 | Controlling User Access: Control Database Access, Privileges, Creating User, Concept of Role, Creating, Granting Privileges to Role, Revoking Privileges. Changing Password | 5 |
| 3 | Managing Schema Object: Data Types, DDL, DML, DCL Constraints: Types of Constraints, Primary Key, Foreign Key, Check Constraint, Not Null, Altering Constraint, Concept of Backup Recovery.<br>Overview of Index, View | 10 |
| 4 | Manipulating Dataset using SQL Statement: Basic Select Statement, Selecting Specific Column, Using Arithmetic Expressions, Defining Column Alias, using Where Clause | 5 |
| 5 | Restricting & Sorting Data: using Comparison Condition (=,<=,>=Etc), Using Logical Operator: AND, OR, NOT, using BETWEEN, LIKE Conditions<br>Rule of Precedence. using Order by Clause | 10 |
| 6 | SQL Function: Displaying Data From Multiple Tables, Sub-Query Concept of Function, Types, Group Functions, Use of Group by, Having Clause. Types of Joins, Concept of Sub-Query, Types of Sub Queries. | 10 |
| 7 | Pl/Sql:<br>Introduction to Pl/Sql, Variables and Types Declaration in Pl/Sql. Simple Program in Pl/Sql: Assignment Operator, Output Statement, Accepting Input from User.<br>Simple Program in Pl/Sql Using Table: Syntax of Using 'Select' Statement in Pl/Sql, 'If' Statement and Loops in Pl/Sql. Creating Procedure, Function, Cursor, Trigger, Packages. | 15 |

Books:


1. Deshpande, P. S. (2008): SQL & PL/SQL for Oracle 10g, Blackbook, Dreamtech Press, New Delhi
2. Freeman, R. G. (2000): Oracle DBA 7.3 to 8Upgrade, Dreamtech Press, New Delhi
3. http://docs.oracle.com/cd/B19306_01/server.102/b14220.pdf
4. http://www.smart-soft.co.uk/tutorial.html
5. http://ask2seenu.blogspot.in/2011/09/best-oracle-plsql-ebooks-download-for.html

| **Code: GE305 Application of GIS and RS Techniques– I** | | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Geosciences: Concepts of Geomorphology, Landform Analysis, Drainage Basin Morphometry, Slope Mapping, Integrated Approach for Landslide Hazard Zonation Models and Mapping.<br>Aerial Photo and Satellite Data Interpretation | **11** |
| 2 | Water Resources: Watershed Hydrology, Physical Processes in Watershed, Principles of Remote Sensing in Water Resource Assessment, River Valley Project, Planning, Organization and Design of Spatial and Non-Spatial Data in Water Resource Engineering. Hydrological Modeling | **11** |
| 3 | Forest: Image Processing for Forest, Vegetation Classification Mapping, Forest Inventory, Sampling Techniques,<br>Growing Stock Estimation, Biomass Estimation, Forest Management, Fire Risk Zonation, Land Evaluation for Forestry, RS of Forest Ecosystem | **11** |
| 4 | Marine and Atmospheric Sciences: Fundamentals Of Marine Ecology, Bio-Resource Monitoring and Mapping, Coastal Bathymetry. Ocean Color Mapping, SST Mapping, Potential Fishing Zone Mapping.<br>Fundamental Principles of Climatology, Structure, Chemical Composition of the Atmosphere, Aerosols, General Circulation, Climate modeling, Meteorological Satellites. Forecasting of Natural Calamities.<br>Air Pollution Modeling | **12** |

Books:


1. SPRS Technical Commission VII(2002): Symposium on Resource Environmental Monitoring, ISRS Annual Convention, IIRS, Dehradun
2. Deekshatulu, B. L.(1990): Description and useofLand use/Landcover, NRSA, Hyedrabad
3. Sudershana, R. Mitra, D. Mishra, Roy, P.S., Rao, D. P.(2000): Subtle Issues in Coastal Management, IIRS, Dehradun
4. Harris, J. E. (1990): Earthwatch – The Climate from space, Ellishorwood Ltd., Midsower Norton
5. Lal, D. S. (1998): Climatology, Chaitanya Publishing House, Allahabad
6. Escalante, R. B. (2012): Remote Sensing- Advances techniques and Plateforms, Intech, Rijeka Croatia
7. Escalante, R. B. (2012): Remote Sensing Application, Intech, Rijeka Croatia
8. Roy, P.S., Dwivedi, R. S. (2010): Remote Sensing Application www.nrsc.gov.in/Learning- Center, E Book. html

| **Code: GE306** | **Programming in .NET** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Lectures: 45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Introduction to .NET Language: .Net Architecture. CLR, CLS, CTS, JIT Compiler<br>C # .Net: Introduction to C# .Net. Syntax Used in Defining Classes, Methods,Variables<br>Interface Abstract Class: Understanding Abstract Classes, Access Modifiers and Interface. Creating and using Custom Interfaces, Sample Programs | 20 |
| 2 | Implementation of OPP: Windows Forms and Console Application. Introduction to Classes Used In .Net, Implementing Oops Characteristics, Working with Windows Forms Application, Console Application, Building Logic in the Sample Application.<br>Event Handling: Handling Various Events in Windows Forms Application<br>Exception Handling: Usage of Try, Catch and Finally Block.<br>.Net Interoperability: Working with Managed and Unmanaged Code | 25 |

Books:

1. Evjen, B., Hollis, B., Rockford, L. (2006): Professional VB.NET (2003), Wiley Publishing Inc. USA
2. Holzner, S. (2010): Visual Basics.NET Programming Black Book, Paraglyph Press USA Dreamtech Press

| **Code: GE307** | **Programming in Python** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Practicals: 15** |
| **Sr. No.** | **Topic** | **Practicals** |
| 1 | Introduction to Python, Python Vs. .NET Vs. JAVA | 1 |
| 2 | Data Type Operators: Data Types, Basic Sample Programming Control Flow, Arrays, Listandstrings.Classes Modules: Creating Modules and Classes, Implementing OOP. | 2 |
| 3 | Script Windows Application: Creating Script Working with Windows Forms.<br>Event Handling: Handling Various Events in Windows Forms Application. | 4 |
| 4 | Exception Handling: Usage of Try, Catch Block.<br>Debugging: Debugging Script for Windows Forms Based Application | 4 |
| 5 | Introduction to Arcpy,Arcpy Function, Arcpy Module, Arcpy Classes, Python Toolbox | 4 |

Note: a) For 3 credits 3 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Books:

1. Lutz, M. (2010): Programming Python, O'Relly Media California,
2. (URL: http://itbook.info/book614)
3. https://wiki.python.org./moin/BeginnersGuide/nonprogrammers.
4. Wes McKinney:Python for Data Analysis.
5. BrianK.Jones:Python Cookbook Recipes for Mastering Python.

| **Code: GE308** | **Open Source GIS** | |
|---|---|---|
| **No. of Credits: 3** | | **No. of Lectures:45** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Open Source GIS: Basic Concepts, Conventional Vs. Database Modeling with Open Source GIS | 5 |
| 2 | Open Geospatial Consortium. Introduction to Q GIS,Generation of Vector Layers, Retrieving Properties of Vector and Raster Datasets. Attribution, Map Composition. | 10 |
| 3 | Open Source GIS Platforms ,Softwares, Libraries,SDK Packages and Advantageous | 20 |
| 4 | Applications of Open Source GIS | 10 |

Books:


1. "Open Source GIS History - OSGeo Wiki Editors". Retrieved 2009-03-21.
2. Jump up to:[a] [b] "An Overview on Current Free and Open Source Desktop GIS Developments - Steiniger and Bocher". *Archived from* the original *on 2012-11-12*. Retrieved 2011-08-05.
3. "GIS Software - A description in 1000 words", S. Steiniger and R. Weibel.
4. "Microsoft MapPoint - Home". *Microsoft.com. 2014-12-31*. Retrieved 2015-07-26.

## Semester IV

| **Code: GE401 Research Methodology and Project Management** | | |
|---|---|---|
| **No. of Credits: 5** | | **No. of Lectures : 75** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Research: Definition, Types (Pure and Applied) Classification | 10 |
| 2 | Routes of Explanation: Inductive and Deductive, Hypothesis, Theories, Laws and Models | 10 |
| 3 | Research Question, Objectives and Significance of Research, Research Design: Data Collection and Analysis | 20 |
| 4 | Presentation of Research Findings: Report Writing and Presentation | 15 |
| 5 | Scientific Journals (Impact Factor, Citation) | 10 |
| 6 | Ethics in Scientific Research | 10 |

Books:


1. Montello, D. and Sutton, P. (2013): An Introduction to Scientific Research Methods in Geography and Environmental Studies, SAGE Publications
2. Gomez, B. and Jones, J. P. III (2010): Research Methods in Geography: A Critical Introduction, John Wiley and Sons
3. Warf, B. (Ed)(2006): Encyclopedia of Human Geography, SAGE Publications, London
4. Goudie, A. (Ed) (2004): Encyclopedia of Geomorphology, Routledge, London
5. Gregory, D., Johnston, R., Pratt, G., Watts, M. and Whatmore, S. (2009): The Dictionary of Human Geography, Wiley-Blackwell, Singapore

| **Code: GE402** | **Programming in HTML, JavaScripting.** | |
|---|---|---|
| **No. of Credits: 5** | | **No. of Lectures: 15** |
| **Sr. No.** | **Topics** | **Lectures** |
| **1** | Introduction: HTML, various HTML Tags like Image, Text, Color, Frames and Tables<br>Working with Tables: Creating Tables, Introduction to Frames<br>CSS: Cascading Styling Sheets, Introduction to DHTML | 2 |
| 2 | Introduction to Java Script, Importance of Java Script, Creating Sample Program.<br>Data Type Operators: Various Data Type and its Importance. Understanding and Using Various Types of Operators. | 5 |
| 3 | Iterative Mechanisms: Various Looping Mechanism, Understanding Loops.<br>If Else and Switch Case<br>Binding: Creating Dynamic Web Pages<br>Understanding DOM API, Dojo Framework and Digits.<br>Debugging in Web Application: Working With Developer Tools In Browser.<br>Layout Engines Used in Various Browsers. | 5 |
| 4 | Introduction to Arcgis API and Google API.Clientlibraries ,Services. | 3 |

Books:

1. Balagurusamy, E.(2011): Programming with JAVA- a Primer, Tata-McGraw Hill Education Pvt. Ltd.,New Delhi
2. Horton, I. (2008): Beginning Java 2, Wiley-India Inc.,New Delhi
3. Holzner, S. (2008):HTML Black Book, Dreamtech Press, India Paraglyph Press, USA

| **Code: GE403 Application of GIS and RS Techniques – II** | | |
|---|---|---|
| **No. of Credits: 5** | | **No. of Lectures: 75** |
| **Sr. No.** | **Topic** | **Lectures** |
| 1 | Disaster Management: Natural and Man-Made Disasters. Types, Zoning and Preparedness | 15 |
| 2 | Urban Planning and Development: Large Scale Mapping for Cadastral Database, Traffic and Parking Surveys, Urban Land Use Classification, Monitoring, Change Detection Analysis, Utility Planning, Integrated Development Planning, Urban Conservation, Transportation Planning and Land Information System | 20 |
| 3 | Agriculture and Soils: Spectral Characteristics of Crop, Crop Inventory, Crop Yield Modelling, Physiographic, Soil Mapping, Crop Water Management, Agro-Ecological Zoning, Land Evaluation | 20 |
| 4 | Biodiversity: Concept Of Ecology and Biodiversity, Biodiversity Management and Conservation Using Geospatial Technology. Biodiversity Mapping, Assessment of Biodiversity Hotspots, Anthropogenic Disturbance and Modeling Species Distribution. Landscape Analysis, Wildlife Habitat Suitability Analysis, Species Inventory | 20 |

Books:


1. NRSA(2002): Symposium Tutorial on Sustainable Agriculture (Volume of Lectures), Hyedrabad
2. NRSA(2001):National Agricultural Drought Assessment Monitoring System, India, Summary Report, Hyedrabad
3. Roy, P. S. (2000):Natural Disaster their Mitigation, IIRS, Dehradun
4. ISRS and IARI (1990):Proceedings of National Symposium on RS for Agricultural Application, New Delhi
5. Roy, P. S.(2002): Biodiversity Characteristics at Landscape Level in North East using satellite Remote Geographical Information System, IIRS, Dehradun
6. Roy, P. S. (2000):Biodiversity Environment by, IIRS, Dehradun
7. ISRS (2000):National Symposium on Spatial Technologies for Natural Hazards Management, IIT, Kanpur
8. Nirupama, (2002): Role of Remote Sensing in Disaster Management, ICIR Research Paper Series N0. 21, Institute for catastrophic loss reduction, University of Western Ontario, Ontario
9. Escalante, R. B. (2012): Remote Sensing- Advances techniques and Plateforms, Intech, Rijeka Croatia
10. Escalante, R. B. (2012): Remote Sensing Application, Intech, Rijeka Croatia
11. Roy, P.S., Dwivedi, R. S. (2010): Remote Sensing Application www.nrsc.gov.in/Learning- Center, E Book. html

| **Code No: GE: 404** | **Project Work** |
|---|---|
| **No. of Credits: 10** | |
| **Sr. No.** | **Topics to be Covered** |
| 1 | Problem Identification and Literature Review |
| 2 | Data Acquisition / Collection |
| 3 | Field Work |
| 4 | Data Processing |
| 5 | Results and Interpretation |
| 6 | Report Writing |
| 7 | Presentation |