# Master of Science in Geoinformatics

## SEMESTER WISE BREAK-UP OF COURSES

### Core Courses

The student should have earned 48 credits from the following 15 core courses (Theory-11, Lab-4):

**Semester I**

1. GIM2101 Principles of Remote Sensing
2. GIM2102 Introduction to GIS
3. GIM2103 Geodesy and GPS
4. GIM2104 Introduction to IT
5. GIM2105 Principles of Programming
6. GIS 2106 Remote Sensing Practical
7. GIM2107 GIS Practical

**Semester II**

8. GIM2201 Digital Image Processing
9. GIM2202 Photogrammetry
10. GIM2203 Spatial Modeling & Analysis
11. GIM2204 Digital Image Processing Lab
12. GIM2205 Spatial Modeling & Analysis Lab

**Semester III**

13. GIM2301 Research Methodology
14. GIM2302 GIS Application Development
15. GIM2303 Web Mapping and Web GIS

### Elective Courses

The student is required to earn at least six credits from 3 Elective courses from the following list of courses:

**Electives for Semester II**

1. GIE2201 Web Technology
2. GIE2202 Geostatistics

3. GIE2203 Database Management System

**Electives for Semester III**

1. GIE2301 Geoinformatics Applications in e-Governance
2. GIE2302 Geoinformatics Applications in Natural Resources Management
3. GIE2303 Geoinformatics Applications in Agriculture
4. GIE2304 Geoinformatics Applications in Water Resources Management

## Project

Students may carry out their internship project in an industry or any reputed academic/research institutes. The internship project aims at giving the student an opportunity to participate and work in a substantive project activity. Typically, the project helps the student to learn about work culture, business processes, technologies, marketing strategies, etc. Under the institute project, the student takes up a research topic or participates in an Institute project under the guidance of a faculty or project coordinator.

The project carries 18 credits.

The contribution of different credit requirements for the degree is summarized below.

| Requirement | Credit |
|---|---|
| Core Courses | 48 |
| Elective Courses | 6 |
| Internship/Project | 18 |
| **Total Credits** | **72** |

## SEMESTER-WISE BREAKUP OF COURSES FOR 2 YEARS

**Semester I**

| No | C.Code | Course Title | C/E | Credits | Faculty | Pre requisites |
|---|---|---|---|---|---|---|
| *1* | GIM2101 | Principles of Remote Sensing | *C* | *4* | | As for admission to M.Sc GI |
| *2* | GIM2102 | Introduction to GIS | *C* | *4* | | ” |
| *3* | GIM2103 | Geodesy and GPS | *C* | *4* | | ” |
| *4* | GIM2104 | Introduction to IT | *C* | *3* | | ” |
| *5* | GIM2105 | Principles of Programming | *C* | *3* | | ” |
| *6* | GIM2106 | Remote Sensing Lab | *C* | *2* | | ” |

| | | | | | | |
|---|---|---|---|---|---|---|
| *7* | GIM2107 | GIS Lab | *C* | *2* | | ” |
| * | - | *Total for Semester I* | | *22* | | |

**Semester II**

| No | C.Code | Course Title | C/E | Credits | Faculty | Pre requisites |
|---|---|---|---|---|---|---|
| *1* | GIM2201 | Digital Image Processing | *C* | *4* | | As for admission to M.Sc GI |
| *2* | GIM2202 | Photogrammetry | *C* | *3* | | ” |
| *3* | GIM2203 | Spatial Modeling & Analysis | *C* | *4* | | ” |
| | GIM2204 | Digital Image Processing Lab | *C* | *2* | | ” |
| | GIM2205 | Spatial Modeling & Analysis Lab | *C* | *2* | | ” |
| *5* | GIE22** | Elective | *E* | *2* | | ” |
| * | - | *Total for Semester II* | | *17* | | |

**Semester III**

| No | C.Code | Course Title | C/E | Credits | Faculty | Pre requisites |
|---|---|---|---|---|---|---|
| *1* | GIM2301 | Research Methodology | *C* | *3* | | As for admission to M.Sc GI |
| *2* | GIM2302 | GIS Customization and Application Development | *C* | *4* | | ” |
| *3* | GIM2303 | Web Mapping and Web GIS | *C* | *4* | | ” |
| *4* | GIE23** | Elective I | *E* | *2* | | ” |
| *5* | GIM23** | Elective II | *E* | *2* | | ” |
| * | - | Total for Semester III | | *15* | | |

**Semester IV**

| No | C.Code | Course Title | Credits |
|---|---|---|---|
| *1* | GIM2407 | Project | 18 |

# SYLLABUS

## Core Courses

### GIM2101 Principles of Remote Sensing

**Core/Elective: Core Semester: I Credits: 4**

1. Fundamentals: Definition – Scope – types- chronological development – Energy sources – Electro Magnetic Radiation – energy interaction in the atmosphere – atmospheric windows – energy interaction with earth surface features – spectral reflectance patterns for different regions of EMR-Platforms – data capture types and systems –Sensors- Resolution: spatial, spectral, radiometric and temporal resolution
2. History of Aerial Photography, principles of photography, Types of Photographs, Elements of Photograph, Aerial Cameras, Stereoscopic Viewing
3. Satellite programs of the world - Data Products – orbit system – sensor characteristics - meteorological, ocean monitoring and telecommunication satellites. Data Products: Types – visual and digital - standard – special products – referencing system – annotation – image interpretation elements.
4. Thermal Remote Sensing: thermal infrared radiation – thermal properties of materials – emissivity of materials – thermal inertia of Earth surface features. Thermal IR detection and imaging – characteristics of TIR images- applications. Radar Remote System-SLAR – components, imaging system– real aperture and synthetic aperture systems – Image characteristics: Hyperspectral Remote Sensing
5. Remote Sensing applications – Soil – Land use\Land cover – Watershed management - Disaster management – Urban Planning

**Text Books**


1. Lillisand T.M. , R.W.Kiefer and Chipman (2004) 5th edition. Remote sensing and image interpretation, John Wiley & Sons, New York.
2. Campbell B.,(2007) Fourth Edition, Introduction to Remote Sensing, The Guildford Press


**References**


1. Hayesm L., [1991] Introduction to Remote Sensing, Taylor and Fransis Publication, London.

2. Henderson, F. M., and Anthony J. Lewis, 1998, Manual of Remote Sensing, Volume 2, Principles and Application of Imaging Radar, 3rd Edition, John Wiley and Sonc Inc, Canada, USA.
3. Sabins F.F Jr.(1987) Remote Sensing: Principles and Interpretation, W.H.Freeman & Co., New York.
4. Curran P.J (1985) Principles of Remote Sensing, Longman, Essek.

**GIM2102 Introduction to GIS**
**Core/Elective: Core Semester: I Credits: 4**

1. Introducing GIS and spatial data: Definition - maps and spatial information - computer assisted mapping and map analysis - components of GIS - people and GIS - maps and spatial data - thematic characteristics of spatial data - other sources of spatial data: census, survey data, air photos, satellite images, field data.

2. Spatial and attributes data modeling and Management: Spatial entities - generalization - Raster and Vector spatial data structures - comparison of Vector and Raster Methods - Acquisition of spatial data for terrain modeling - Raster and Vector approach to digital terrain modeling - modeling network - layered approach and object - modeling third and fourth dimension - database management system - relational database model - linking spatial and attribute data

3. Data Input and Editing: Integrated GIS database - Encoding methods of data input: keyboard, manual digitizing scanning and automatic digitizing methods, electronic data transfer - data editing: methods of developing and correcting errors in attributes and spatial data: reproduction, transformation and generalization - edge matching and rubber sheeting.

4. Data Analyzing Operation in GIS: Terminologies - Measurements of lengths, perimeter and area in GIS - queries - reclassification - buffering and neighborhood functions - integrated data - Raster and Vector overlay method: point-in-polygon, line-in-polygon and polygon- on-polygon - problems of Raster and Vector overlays - spatial interpolation - GIS for surface analysis - network analysis: shortest path problem, travailing problem, location allocation of resources - route tracing.

5. GIS Modeling for decision support: Models of spatial processes: - conceptual models - mathematical model - models of physical and environmental processes - problems related to using GIS to model spatial processes. Maps as output - alternative cartographic outputs - non-cartographic outputs - spatial multimedia - delivery mechanism - GIS and spatial decision supports - maps as decision tools.

**Text Books**

1. Heywood.L, Comelius.S and S. Carver (2006) An Introduction to Geographical Information Systems, Dorling Kinderseley (India) Pvt. Ltd.

2. Burrough P A 2000 P A McDonnell [2000] Principles of Geographical Information systems, London: Oxford University Press.

**References**


*1.* Lo.C.P., Yeung. K.W. Albert (2002) Concepts And Techniques of Geographic Information Systems, Prentice-Hall of India Pvt ltd, New Delhi

*2.* Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005) *Geographic Information Systems and Science*. Chichester: Wiley. 2nd edition

3. Burgh P.A (1986) Principles of geographical Information System for Land Resources Assessment, Clarendon Press, Oxford.


**GIM2103 Geodesy and GPS**
**Core/Elective: Core Semester: I Credits: 4**

1. Fundamentals of Geodesy: Definition and scope of Geodesy, Earth, Geoid, and Ellipsoid of rotation, Reference surfaces and coordinate systems in Geodesy, Indian Geodetic System and Everest Spheroid, World Geodetic System 84(WGS 84).
2. Geometric and Physical Geodesy: Geometry of Ellipsoid of rotation, Normal sections, Principal radii of curvature, Geodetic coordinates and Natural coordinates, Classification of control survey, 1st and 2nd order horizontal control by triangulation, Trilateration, surfaces and plumb lines, Attraction and potential, Gravity, Gravitational potential and gravity potential, Fundamental equation of Physical Geodesy, Astro-geodetic determination of Geoid.

3. Fundamentals of GPS: Introduction, Space segment, User segment and Control segment, Observation principle and signal structure, Intentional limitation of system accuracy, system development. Point positioning and relative positioning, GPS Observations and Data Processing: Code and carrier phase observables, Linear combinations and derived observables

4. GPS Receivers: Receiver Concepts and main receiver components, Examples of GPS receivers, Classical receivers, Examples of currently available geodetic receivers, Navigational receivers, Future developments.

5. Planning and Realization of GPS Observations: Methods of surveying with GPS, Static, and Kinematic positioning, Navigation with GPS, Differential GPS. DGPS Surveys- application of DGPS surveys and the associated limitations.

**Text Books**


1. Torge, Wolfgang. 1991 Geodesy, 2nd Edition, New York: deGruyter.
2. B. Hofmann-Wellenhof and H. Moritz, *Physical Geodesy*, Springer-Verlag Wien, 2005.


**References**


1. P. Misra and P. Enge. 2001, Global Positioning System Signals, Measurements, and Performance. Lincoln, Massachusetts: Ganga-Jamuna Press.
2. Kaplan, Understanding GPS: principles and applications, 1996, 1st ed. Norwood, MA 02062, USA: Artech House, Inc.
3. Gopi Satheesh, Sathikumar.R., Madhu N., 2007, Advanced Surveying, Total Station, GIS and Remote Sensing, Dorling Kindersley (India) Pvt. Ltd.


**GIM2104 Introduction to IT**
**Core/Elective: Core Semester: I Credits: 3**

1. Introduction to Computer System: Hardware and Software - Hardware Components of a Computer - Processor - Main memory - Secondary Memory - Input Devices - Output devices - Storage and Backup Devices - Software Component - Software/Program - Operating System - Application Software/Program - Software for e-Governance
2. Operating System: OS Functions - OS Services - Types of OS – Windows - Unix/Linux - Solaris - Real Time OS - Distributed OS – OS for Mobiles Computer Programming: Assemblers – Compilers – Interpreters - Machine Code - Assembly Language - High Level Languages - Systematic Programming - Object-Oriented Programming
3. Computer Network: Communication Between Computers – LAN – WAN – INTERNET - World Wide Web - Repeater - Hub - Switch - Router - Gateway - Communication Protocols
4. Principles of Programming: Datatypes and Designing Programs Scope, Contracts and Invariants: Higher Order Functions and Recursion: Mutation and Sequencing: Objects: Objects in Javascript
5. Software Engineering and Models: Requirements Management: Requirement Analysis, SRS preparation, Requirement Review, Software Measurements, Software Testing and Quality:

**Text Books**

1. John L. Hennesy, David A. Patterson Computer Organization and Design: The Hardware / Software Interface (Third Edition), Morgan Kaufmann, 2004
2. Harold Abelson and Gerald Jay Sussman, with Julie Sussman, Structure and Interpretation of Computer Programs, MIT Press, 2nd ed., 1996

**References**


1. Doublas E. Comer, Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4th Edition) Prentice Hall, 4th Edition.
2. Pressman R.S, Software Engineering: A Practitioner's Approach ($6^{th}$ Edition), McGraw Hill, 2005
3. Gary Nutt, Operating Systems: A Modern Perspective, Pearson Education Asia 2nd Edition 2000


**GIM2105: Principles of Programming**
**Core/Elective: Core Semester: I Credits: 3**

1. Introduction to Principles of programming, Art of language design, Programming language spectrum, Compilation and interpretation – Lexical and Syntax analysis, Semantic analysis and Intermediate code generation, Target code generation, code improvement. Programming Language Syntax: Specifying Syntax, Scanning, Parsing.

2. Names, Scopes and Binding – The notion of binding time, Object lifetime and storage management, scope rules, Implementing scope, The binding of referencing environments, binding within a scope, separate compilation.

3. Semantic analysis – attribute grammars, evaluating attributes, action routines, space management for attributes, decorating a syntax tree, Target machine architecture – data representation, instruction set architecture, architecture and implementation.

4. Issues in Language design: Control flow – Expression evaluation, Structure and unstructured flow, sequencing, selection, iteration, recursion, nondeterminacy. Data types: Type systems, type checking, records and variants, arrays, strings, sets, pointers, recursive types, lists, Files and Input/Output. Subroutines and control abstraction – calling sequences, parameter passing, exception handing.

5. Data Abstraction and Object Orientation: Encapsulation and inheritance, initialization and finalization, dynamic method binding, multiple inheritance, Alternative programming models

**Text Books**


1. Michael Scott, Morgan, Programming Language Pragmatics. Kaufmann, 2000.
2. Daniel P. Friedman, Mitchell Wand, Christopher T. Haynes Essentials of Programming Languages. MIT Press, 2nd Edn. 2001


**References:**


1. Peter Van-Roy, Seif Haridi, Concepts, techniques, and models of computer programming, MIT Press, 2004
2. Matthias Felleisen, How to design programs: an introduction to programming and computing, MIT Press, 2001
3. Friedman, Wand and Haynes, Essentials of Programming Languages. Prentice-Hall International (PHI), 1998.


**GIM2106 Remote Sensing Lab**
**Core/Elective: Core Semester: II credits: 2**

1. Familiarization with mirror
2. Familiarization with prism stereoscopes
3. Marginal Information of aerial photograph
4. Orientation of stereo model and marking principle point, fiducial axes and flight line.
5. Computing photo scale using known objects
6. Visual Interpretation of Satellite images-Keys of Interpretation
7. Familiarizing various satellite image formats
8. Loading Digital images in Remote Sensing software
9. Familiarizing Digital Satellite Images-Spectral Reflectance values, Resolution
10. Interpretation of Thermal images and Radar Images

**Text Books**


3. Lillisand T.M. , R.W.Kiefer and Chipman (2004) 5th edition. Remote sensing and image interpretation, John Wiley & Sons, New York.
4. Campbell B.,(2007) Fourth Edition, Introduction to Remote Sensing, The Guildford Press


**References**


1. Hayesm L., [1991] Introduction to Remote Sensing, Taylor and Fransis Publication, London.
2. Henderson, F. M., and Anthony J. Lewis, 1998, Manual of Remote Sensing, Volume 2, Principles and Application of Imaging Radar, 3rd Edition, John Wiley and Sonc Inc, Canada, USA.
3. Sabins F.F Jr.(1987) Remote Sensing: Principles and Interpretation, W.H.Freeman & Co., New York.


**GIM2107 GIS Lab**
**Core/Elective: Core Semester: II credits: 2**

1. Georeferencing scanned map
2. Creating layers; point, polyline and polygon
3. Managing Projection & Datums
4. Managing attribute table
5. Managing Dimension; area and length
6. Symobolizing layers
7. Overlaying with Google Earth
8. Join\Relate layers with External Database
9. Converting XY Data to GIS format
10. Designing Cartographic Output

**Text Books**


1. Heywood.L, Comelius.S and S. Carver (2006) An Introduction to Geographical Information Systems, Dorling Kinderseley (India) Pvt. Ltd.

2. Burrough P A 2000 P A McDonnell [2000] Principles of Geographical Information systems, London: Oxford University Press.

**References**


1. Lo.C.P., Yeung. K.W. Albert (2002) Concepts And Techniques of Geographic Information Systems, Prentice-Hall of India Pvt ltd, New Delhi

2. Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005) *Geographic Information Systems and Science*. Chichester: Wiley. 2nd edition

3. Burgh P.A (1986) Principles of geographical Information System for Land Resources Assessment, Clarendon Press, Oxford.


**GIM2201 Digital Image Processing**
**Core/Elective: Core Semester: II Credits: 4**

1. Principles: Data encoding and decoding - digital image formats - band sequential and band interleaved - characteristic features. software - raster and vector files
2. Image Rectification and Restoration: geometric correction, radiometric correction - noise removal - image enhancement: contrast manipulation - graylevel threshold, level slicing, and contrast stretching.
3. Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters : Smoothing – Sharpening filters – Homomorphic filtering. Principal components.
4. Vegetation components - intensity - hue - saturation colour space transformation. Pattern Resolution: concepts - linear and non- linear discriminate function.
5. Image Classification: Supervised classification - classification stage - minimum distance to Means classifier - parallelepiped classifier - Gauss maximum likelihood classifier - training stage - Unsupervised classification - output stage - post classification smoothing - classification accuracy assessment.

**Text Books**


1. Lillisand T.M. , R.W.Kiefer and Chipman (2004) 5th edition. Remote sensing and image interpretation, John Wiley & Sons, New York.
2. American Society of Photogrammetry, (1983). Manual of Remote Sensing, (2nd edition), ASP, Falls Church, Virginia


**References**


1. Ekstrom, M. P. 1984, Digital image processing techniques. New York, Academic Press.
2. Harris,R. 1987, Satellite Remote Sensing - An Introduction. London, Routledge.
3. Moffit, H.F., and Edward, M.M., (1980). Photogrammetry, Harperand Row Publishers, New York.

**GIM2202 Photogrammetry**
**Core/Elective: Core Semester: II Credits: 4**

1. Flight Planning: Flight map – end lap and side lap – scale – flight altitude - base height ratio – ground coverage and stereoscopic model – flight line spacing.

2. Photo Mosaic : Number of photos and film roll – exposure time and interval – drift angles - seasons and weather conditions – Mosaics – Ground Control point – Mosaic types and characteristics.

3. Stereoscopic Plotting Procedures and Instruments : Direct optical projection plotters projection system, viewing system, measuring and tracing system - orientation of photography – stereo plotters with mechanical or optical – mechanical projection.

4. Instruments using the Zeus Parallelogram, instruments with optical – Mechanical pr ojections – Automated Stereo plotting Instruments: electronic image correlation and automatic stereo plotters, analytical plotters.

5. Orthophotography : Meaning, need, procedure, characteristics, uses and problems – Digital Photogrammetry.

**Text Books**


1. Kraus K, 2007: Photogrammetry:geometry from images and laser scans, 2nd edition, Walter de Gruyter, Germany
2. Mikhail M, bethel S, McGlone C.(2001), Introduction to Modern Photogrammetry, John Wiley and Sons, Inc.


**References**


3. Moffit H.F. And Edward, M.M, 1980 : Photogrammetry, 3rd Edition, Harper And Row Publishers, New York.
4. Burside, C.D., 1985 : Mapping From Aerial Photographs, Collins Publishers.
5. Kasser M, Egels Y (2002) Digital Photogrammetry, Taylor & Francis.


**GIM2203 Spatial Modeling & Analysis**
**Core/Elective: Core Semester: II Credits: 4**

1. Modeling Spatial Problems **:** Introduction - need for spatial models – conceptual model for solving spatial problems - steps involved. Types of spatial models – descriptive and process models – types of process models – creating conceptual models - site suitability model.

2. Raster Modelling : Understanding raster data set - composition of raster dataset coordinate space and raster data set – discrete and continuous data – resolution – raster encoding – representing features in raste r data set – assigning attributes.

3. Spatial Analysis **:** Understanding spatial analysis - operators and functions – local, focal, zonal, global and application functions – surface analysis: slope, hill shade, contour and hydrologic analysi s – mapping distance: shortest path – mapping density – cell statistics – neighborhood statistics – reclassification.

4. Creating Surface models: Introduction – creating raster surface from points – interpolating a raster surface – creating TIN surface from vector data – building TIN – creating a TIN from a raster – creating a raster from a TIN.

5. Analyzing Surfaces: Understanding the shape of a surface – calculating slope, mapping contours - deriving contour lines from a surf ace – calculating area and volume.

**Text Books**


1. Heywood.L, Comelius.S and S. Carver (2006) An Introduction to Geographical Information Systems, Dorling Kinderseley (India) Pvt. Ltd.
2. Heywood, Cornellius and Carver, 2001, 2 nd Indian Reprint. A n Introduction to Geographical Information Systems Parsian Education (Singapore ) Pte. Ltd., Indian Branch, Delhi – 110 092, India.


**References**


1. Tsung Chang – Kang, 2002, Introduction to Geographic Information Systems, Tata McGraw -Hill Publishing Comp any Limited, New Delhi.
2. Zeiler Michael, 2002, Modeling Our World, The ESRI Guide to Geodatabase Design, Environmental Systems Research Institute, Inc., Red Lands, California. USA- 92373 -8100.
3. Mitchell, A., , 1999, The ESRI Guide to GIS Analysis Volume 1: Geographical Patterns and Relationships, Environmental Systems Research Institute, Inc., Red Lands, California. USA 92373 –8100


**GIM2204 Digital Image Processing Lab**
**Core/Elective: Core Semester:III credits: 2**

1. Geometric Correction
2. Radiometric correction
3. Histogram construction for digital data
4. Outputs of linear and non-linear stretch

5. Filtered outputs
6. Ratio images
7. Change detection analysis
8. Image classification based on digital values
9. Unsupervised classification
10. Supervised classification

**Text Books**


3. Lillisand T.M. , R.W.Kiefer and Chipman (2004) 5th edition. Remote sensing and image interpretation, John Wiley & Sons, New York.
4. American Society of Photogrammetry, (1983). Manual of Remote Sensing, (2nd edition), ASP, Falls Church, Virginia


**References**


4. Ekstrom, M. P. 1984, Digital image processing techniques. New York, Academic Press.
5. Harris,R. 1987, Satellite Remote Sensing - An Introduction. London, Routledge.
6. Moffit, H.F., and Edward, M.M., (1980). Photogrammetry, Harperand Row Publishers, New York.


**GIM2205 Spatial Modeling & Analysis Lab**
**Core/Elective: Core Semester:III credits: 2**

1. Spatial and tabular query
2. Overlay analysis
3. Extract analysis
4. Proximity analysis
5. Spatial Interpolation: IDW and Kriging
6. Spatial Autocorrelation
7. Network analysis
8. Generating TIN
9. Generating DEM
10. 3D and Volume analysis

**Text Books**

3. Heywood.L, Comelius.S and S. Carver (2006) An Introduction to Geographical Information Systems, Dorling Kinderseley (India) Pvt. Ltd.

4. Burrough P A 2000 P A McDonnell [2000] Principles of Geographical Information systems, London: Oxford University Press.

**References**


4. Lo.C.P., Yeung. K.W. Albert (2002) Concepts And Techniques of Geographic Information Systems, Prentice-Hall of India Pvt ltd, New Delhi

5. Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005) *Geographic Information Systems and Science*. Chichester: Wiley. 2nd edition

6. Burgh P.A (1986) Principles of geographical Information System for Land Resources Assessment, Clarendon Press, Oxford.


**GIM2301 Research Methodology**
***Core/Elective: Core Semester: III Credits: 2***

1. Research Problem: Meaning of research problem-Sources of research problem-Criteria / Characteristics of a good research problem-Errors in selecting a research problem-Methods of Research: Qualitative research and Quantitative research - experimental research, Quasi- experimental research, Surveys, Correlation studies- Action research
2. Developing a Research Proposal: Format of research proposal-Individual research proposal-Institutional proposal-Hypothesis: Meaning-Types of hypothesis.
3. Sampling: Sampling and Population, Techniques sampling selection, Characteristics of a good sample, Sampling errors and how to reduce them
4. Tools and Techniques of Data Collection: Checklist, Data schedule, Observation, Opinionnaire, Interview, Sociometric techniques, Questionnaire, Rating scales, Interview schedules, Reliability and validity of various tools and techniques
5. Research Report: Format of the Research Report, Style of writing the report, References and Bibliography -Evaluation of Research: Criteria of evaluation

**Text Books**


1. Research Methodology . Methods & Techniques : Kothari, C.R.
2. Tests, Measurements and Research Methods in Behavioural Sciences . Singh, A.K.

**References**


1. The Craft of Research, 2nd Edition (Chicago Guides to Writing, Editing and Publishing). Wayne C. Booth, Joseph M. Williams, Gregory G. Colomb.
2. Wayne Goddard, Stuart Melville, Research Methodology: An Introduction 2nd Edn, Juta Juta Academic , Lansdowane, 2004
3. John W. Creswell, Research design: Qualitative, Quantitative, and Mixed Method Approaches, 2nd Edn, SAGE, 2003


**GIM2302 GIS Application Development**
**Core/Elective: Core Semester: III Credits: 4**

1. Customization of GIS: Overview- the need and benefit of Programming - programming for GIS applications - the expansion of GIS through customization and related capabilities - Automation of redundant processes - Data development/update automation - -user/Part-time-user tool development - Discuss resulting understanding of Business Case and Problem Solving.
2. Programming concepts: object-oriented concepts of applications and of programming development - Discuss component programming concepts - logic model - organizational understanding to logic modeling - visioning to logic modeling - Research logic model elements - Demonstrate logic modeling process - Develop simple, sample logic model
3. Java Review: Write, debug and repair java code for GIS-Integration of code in GIS environment.
4. Introduction to ArcObjects: Introduction to ArcGIS family of products-Programming ArcGIS using ArcObjects-understanding Component Object Model (COM)
5. Programming ArcObjects using Java : Introduction- - understanding ArcObjects class packages- components of ArcObject-Understanding Object Model Diagrams-Fundamental Object Model Diagram components-Object Model Diagram symbols- different types of class relationships-working with events-Accessing and Rendering Data-Querying and selecting data-working with geometry-creating and editing data

**Text Books**


1. Jo Wood, 2002. Java programming for spatial sciences, CRC Press.
2. Robert Burke, Andrew Arana, Thad Tilton, 2003. Getting to Know About ArcObjects: Ingram Publisher Services.


**References**

1. Stuart Dabbs Halloway(2002)Component Development for the Java platform: Addison-Wesley
2. Michael Zeiler, 2001. Exploring ArcObjects: ESRI

**GIM2303 Web Mapping and Web GIS**
**Core/Elective: Core Semester: III Credits: 4**

1. Introduction: Internet, web and Internet. Fundamentals of computer networking – network environment – network communication models – protocols – TCP/IP.

2. Web mapping – static and interactive web mapping, collaborative web mapping. Web Mapping Services-OpenLayers-Goggle maps-yahoo maps and Microsoft map services, Mashups, GeoRSS

3. Distributed geographic information services – principle – components – logic and data components.
4. Open Geospatial Consortium- Web Map Servers- WMS-, interoperable systems and non-interoperable systems- Web Feature Servers- Metadata standard, XML, Geographic Markup Landguage -
5. Client/server computing– client/server system partition – layered architecture – advantages and disadvantages of client and server side architecture. Distributed component framework – Web GIS Implementation: Web Map servers and Data servers, Configuration, layering, design of interfaces, Quality of Service and Security Issues in the Development of Web GIS - Performance, Security, Scalability

**Text Books**

1. Korte,G. B., (2001) The GIS book: 5th Edition, Onward press, Australia. Cartwright, W., M.P. Peterson, G. Gartner (Eds) Multimedia Cartography, Berlm: Springer.
2. Kraak,M., and A.Brown (2001) Web Cartography: Development and Prospects, London: Taylor and Francies.

**References**

1. Kraak, M. and F. Ormeling (2003) Cartography: Visualization of Geospatial Data, Delhi: Pearson Education.
2. Ron Lake, David S. Burggraf, Milan Trninic, Laurie Rae, 2004, Geography mark-up language (GML) John Wiley & Sons Ltd.

## Elective Courses

**GIE2201 Web Technology**
**Core/Elective: Core Semester: II Credits: 3**

1. Introduction –overview of web technology, Introduction to the web model of computing: distribution, protocols, user interface ad HTML and Javascript
2. Issues of Web Technology- Architectural Issues of Web Layer, HTTP, FTP Protocols, Tier technology, 2-tier and n-tier
3. The Client Tier – Representing content, XML, DTD's schemas, stylesheets and transformation, CSS, XSL, XSLT
4. The Server Tier – Web Server Concept, Creating dynamic content, Using control flow to control dynamic content generation, Sessions and State, Error Handling, Authentication, Architecting Web Application, Using tag libraries, Writing tag libraries
5. Rich Internet Applications: CSS, Javascript, AJAX, Web2.0, Mashups, RSS

**Text Books**


1. Anders Miller and Michael I. Schwartzbach, An Introduction to XML and Web Technologies, Addison-Wesley, January 2006.

2. Mark Lutz, Programming Python, O'Reilly, 2006.


**References**


1. Christian Bauer and Gavin King, Hibernate in Action, Manning Publications, 2004.

2. Ramesh Nagappan, Robert Skoczylas, Rima Patel Sriganesh, Developing Java Web services: architecting and developing secure Web services using Java, John Wiley and Sons, 2003.

3. Stephanie Bodo_, Dale Green, Kim Haase, Eric Jendrock, Monica Pawlan, Beth Stearns, The J2EE tutorial, Addison-Wesley, 2002.

**GIE2202 Geostatistics**

**Core/Elective: Core Semester: III Credits: 3**

1. Fundamental concepts -Histogram – univariate and bivariate, estimation of basic statistical parameters, viz., mean, standard deviation, variance, correlation, covariance.Introduction to probability theory. Kinds of probability – classical or apriority probability,
2. Random variables, Distribution functions and expectation: Introduction and summary, Cumulative distribution function, Density function, Expectations and moments.
3. Estimation theory: Introduction and summary, methods of finding estimators, properties of point estimators, unbiased estimation, Sampling and sampling distribution, sample mean, sampling from normal distribution.
4. Testing of hypothesis: Introduction and summary, simple hypothesis testing, composite hypothesis, tests of hypotheses – sampling from normal distribution, chi-square tests, tests of hypotheses and confidence intervals, sequential test of hypotheses.
5. Geostatistics – introduction, The variogram – calculation, interpretation, Variances, covariances, Krige's volume-variance relationship. Extension variances and estimation variances – simple calculations in one and two dimensions. Optimal estimation – introduction to kriging, Linear, Non-linear and Multivariate Geostatistics

**Text Books**

1. Noel Cressie, 1991.Statistics for Spatial Data, John Wiley & Sons
2. Isaaks, E. H. and R. M. Srivastava. 1989. An Introduction to Applied Geostatistics. Oxford Univ. Press, New York, Oxford

**References**

1. Yang, X. S., 2009, Introductory Mathematics for Earth Scientists, Dunedin Academic Press
2. Volk, W, 1980, Applied Statistics for Engineers, Krieger Publishing Company, Huntington, New York
3. Wackernagel, H. 2003. Multivariate geostatistics, Third edition, Springer-Verlag, Berlin

**GIE2203 Database Management System**

**Core/Elective: Elective Semester: II Credits: 3**

1. Introduction to Database Management Systems: Data, Information, Database, Transaction and its desired properties, File Server Model, Client Server Model, Advantages of using DBMS over conventional methods, DBMS Features, Components of DBMS, Data Abstraction, Data Independence.

2. Data Modeling: Logical and Physical Data Models, E-R Modeling, Record Based Models, Relational Model An overview, Relational Concepts, Tables, Keys, Constraints, Data Integrity and Constraints, Integrity Rules, Normalization
3. Introduction to SQL: Introduction to SQL, SQL Features, SQL Operators, SQL Datatypes, SQL Parsing, Types of SQL Commands, Querying Data from the database, Correlated Sub-queries, Joins, Hierarchical Queries, PL/SQL Introduction

4. Distributed Databases: Structure and design, Distributed query processing, Recovery, Commit protocols, Concurrency controls, Deadlock handling, Shadow paging

5. Emerging trends Object Oriented databases, Object oriented queries Active databases Deductive databases concepts of next generation databases, XML, Data Warehouses Data Mining

**Text Books**


1. Abraham Silberschatz; Henry F Korth, Database System Concepts, McGraw Hill Publication, 2002

2. Won Kim, Introduction to Object-Oriented Databases, MIT Press, 1990


**References**


1. Stefano Ceri; Giuseppe Pelagatti, Distributed Databases: Principles and Systems, Universities Press, 2000

2. Jan L Harrington, Object Oriented Database Design Clearly Explained, Harcourt, 2000

3. Elmasri,Ramez; Navathe, Shamkant B, Fundamentals of Database Systems, Pearson, 2000

**GIE2301 Geoinformatics Applications in e-Governance**
**Elective Course: Elective Semester: III Credits: 3**

1. Large Scale Mapping: Technologies for Larges Scale Mapping (LSM) – Aerial Photography – High – Resolution Satellite Remote Sensing – Electronic Distance Measurement (EDM) – Total Station – Differential Global Positioning System (DGPS) – Issues in Large Scale Mapping – selecting appropriate techniques and methodologies.
2. Cadastral Information System: Concept of Cadastre, History of cadastral survey methods and survey maintenance, cadastral map reproduction, development of cadastral information system.
3. Urban and Regional Planning: Scale and resolution concepts and interpretation techniques for urban and regional analysis. Plans – planning needs, types of plans, urban and regional planning. Land transformation and sprawl studies; Site selection for urban development, transportation network analysis etc.
4. AM/FM applications: GIS/GPS application in Automated mapping (AM) and Facility management (FM) – Water and sewage related; Electric and power supply related; demographic related; locations of facilities like medical schools, banks, ATMs etc related. Telecom applications
5. Demographic and business Applications – Crime Analysis, Electoral Redistricting Marketing and Retailing Network Applications, Vehicle Routing – Scheduling, Vehicle Tracking and Navigation: Integration of GPS and GIS data.

## Text Books


1. Burrough P.A., 1986. Principles of Geographical Information Systems for Land Resources Assessment, Oxford University Press
2. Batty, P. M., 1996: The Impact of New Technologies on AM/FM/GIS: Proceedings of AM/FM International Conference XIX


### References


1. Shamsi U M, 2002, GIS Tools for Water, wastewater and storm water systems, American Society of Civil Engineers.
2. Meehan Bill, 2007, Empowering Electric and Gas Utilities with GIS, ESRI.Press

**GIE2302 Geoinformatics Applications in Natural Resources Management**
**Elective Course: Elective Semester: III Credits: 3**

1. Natural Resource Evaluation: Need – objectives – sources of data – limitations – need for evaluation in development planning

2. Land Evaluation: Objectives – principles – procedures – approaches – land use requirements and land quality parameters – layer creation – matching – classification – case studies.

3. Wastelands: Types – identification – management – eroded lands – types – layer creation – case studies.

3. Water Resources: Surface water: precipitation – space time analysis – overland flow – storage – groundwater: potential – quality – layer creation – overlay analysis – integrated watershed development – case studies.

4. Natural Vegetation: Forests – classification (NRSA) – grasslands – layer creation overlay – management – case studies.

**Text Books**


1. Fischer, M., H.J. Scholten, and D. Unwin, 1996. Spatial Analytical Perspectives on GIS , Taylor & Francis, London, UK.
2. Michael F. Goodchild, Louis T. Steyaert, Bradley O. Parks, 1996. GIS and Environmental Modeling: Progress and Research Issues. Fort Collins, CO 80525: GIS World Inc.


**References**


1. Ripple, William J. (ed.). 1994. The GIS Applications Book: Examples in Natural Resources: A Compendium , American Society for Photogrametry and Remote Sensing, Bethesda, Maryland.
2. Young, Haines, David Green, and Steven Cousins (eds.), 1994. Landscape Ecology and GIS , Taylor & Francis, Bristol, P.A.
3. Fotheringham, S., and P. Rogerson, Ed. 1995. Spatial Analysis and GIS , Taylor & Francis, London, UK.


**GIE2303 Geoinformatics Applications in Agriculture**
**Elective Course: Elective Semester: III Credits: 3**

1. Crops: Introduction - Agriculture Ecosystems, Yield parameters, spectral properties of crops, identification of crops and acreage estimation, vegetation indices, production forecasting through digital analysis, monitoring and condition assessment - case studies

2. Soils: introduction - Soil survey methods, soil classification, Land evaluation, Saline, alkaline soils, soil mapping, soil identification and mapping of problem soils, sedimentation and erosion, soil conservation - case studies.
3. Field-scale applications of RS and GIS: soil moisture content assessment, crop phenologic stage identification, crop biomass and yield production estimation, crop disease, weed and insect infestation detection and monitoring, farms mapping, cropping system analysis, agro-ecological zoning.

4. Retrieval of agrometeorological parameters from satellites, floods and droughts assessment and monitoring, water and wind induced soil erosion assessment and monitoring

5. Precision Agriculture: Definition and rationale: agronomy, environment, economics, Tools: variable rate technology (VRT), GPS, GIS, Yield monitoring and mapping, Developing prescriptive maps for VRT management, Applications

**Text Books**


1. Pierce J.Francis and Clay David, 2007, GIS Applications in Agriculture, Taylor & Francis Group
2. Steven, M.D. and Clark, J.A., Butterworths, 1990, Application of Remote Sensing in Agriculture, London.


**References**


1. Ripple, William J. (ed.). 1994. The GIS Applications Book: Examples in Natural Resources: A Compendium , American Society for Photogrametry and Remote Sensing, Bethesda, Maryland.
2. Young, Haines, David Green, and Steven Cousins (eds.), 1994. Landscape Ecology and GIS , Taylor & Francis, Bristol, P.A.
3. William Ripple,1986, Geographic Information Systems for Resource $60.00 Management, ACSM.


**GIE2304 Geoinformatics Applications in Water Resources Management**

**Elective Course: Elective Semester: III Credits: 3**

1. Introduction: Hydrologic cycle, components of hydrologic cycle - processing and parameterization in hydrology; Water resource scenario in India, Hydrological modeling. GIS applications in water resources development and management.
2. Floods and flood management. Spectral properties of water. Floods types; causes and mitigation measures, flooding potential zonation mapping, flood hazard assessment, flood risk analysis using RS and GIS, RS and GIS in Cyclone mapping and mitigation, digital surface modeling and flood hazard simulation

3. Ground water resources: Groundwater, hydro geomorphology, Ground water potential assessment, groundwater prospect zones mapping, ground water modeling, ground water information system, planning and management of ground water. Groundwater quality mapping. Ground and surface water interactions
4. Irrigation management**:** Mapping and monitoring of catchments and command areas, land irrigability, soil irrigability mapping, irrigation canal alignment, crop norm violation, agriculture water demand estimation for different crops, tank information system, wet land mapping, siltation mapping, optimum usage planning and management of irrigation water.
5. Watershed management**:** Watershed- Drainage and water body mapping, morphometric analysis, classification, delineation and coding of watersheds, reservoir sedimentation - watershed development planning, watershed prioritization, Watershed Information System; mapping drought-prone areas.

**Text Books**


1. John G Lyon, 2003, GIS for Water Resources and Watershed Management, CRC Press LLC
2. K.Kovar & H.P. Nachtnebel, 1996, Application of Geographic Information Systems in Hydrology and Water Resources Management, International Association of Hydrological Sciences


**References**


1. Lynn E.Johnson [2002] Geographic Information Systems in Water Resources Engineering, CRC Press LLC
2. Jain S.K and Singh V.P., 2003, Developments In Water Science –Water Resources Systems Planning and Management, Antony Rowe Ltd
3. U.M.Shamsi, 2002, Water, Waste water and Storm Water Systems, American Society of Civil Engineers