PROSPECTUS
OF
MASTER OF SCIENCE IN
GEOINFORMATICS
Semester-I, Winter 2012
Semester-II, Summer-2013
Semester-III, Winter-2013
Semester-IV, Summer-2014

2012
(Visit us at www.sgbau.ac.in)

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**M.Sc. (Geoinformatics) Prospectus No.20131237**

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## Syllabi prescribed for Master of Science in Geoinformatics

### Semester I to IV

#### Semester I

1. MGI - 101 Priniples of Remote Sensing
2. MGI - 102 Introduction to GIS
3. MGI - 103 Geodesy and GPS
4. MGI - 104 Introduction to IT
5. MGI - 105 Remote Sensing Practical
6. MGI - 106 GIS Practical

#### Semester II

1. MGI - 201 Principles of Cartography
2. MGI - 202 Digital Image Processing
3. MGI - 203 Photogrammetry
4. MGI - 204 Spatial Modeling & Analysis
5. MGI - 205 Digital Image Processing Lab
6. MGI - 206 Spatial Modeling & Analysis Lab

#### Semester III

1. MGI - 301 Research Methodology
2. MGI - 302 GIS Application Development
3. MGI - 303 Geoinformatics Applications in Natural Resources Management
4. MGI - 304 Geostatistics
5. MGI - 305 Geostatistics Lab.
6. MGI - 305 GIS Applications in Natural Resource Management Lab

#### Semester IV

1. MGI - 401 Database Management System
2. MGI - 303 Web Mapping and Web GIS
3. MGI - 403 Geoinformatics Applications in Agriculture
4. MGI - 404 Geoinformatics Applications in Water Resources Management
5. MGI - 405 GIS Applications to agriculture and Water Resources (Lab)
6. MGI - 405 Project (Lab)

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### Syllabus prescribed for M.Sc. Geoinformatics (Semester-I)

#### 101- Principles of Remote Sensing


**Unit 2:** History of Aerial Photography, principles of photography, Types of Photographs, Elements of Photograph, Aerial Cameras, Stereoscopic Viewing.

**Unit 3:** Satellite programs in India - Data Products – orbit system – sensor characteristics, Data Products: Types – visual and digital - standard – special products – referencing system – annotation – image interpretation elements.


**Unit 5:** Remote Sensing applications – Soil – Land use/Land cover – Watershed management - Disaster management – Urban Planning

### Text Books


### References

102- Introduction to GIS

Unit 1 : Definition - maps and spatial information - components of GIS, maps and spatial data - thematic characteristics of spatial data - other sources of spatial data: census, survey data, air photos, satellite images, field data.

Unit 2 : Spatial and attributes data - Spatial entities - 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 database management system - linking spatial and attribute data.


Unit 5 : Models of spatial processes: - conceptual models - models of physical and environmental processes - problems related to using GIS to model spatial processes. Maps as output - alternative cartographic outputs - non-cartographic outputs maps as decision tools.

Text Books

References

103- Geodesy and GPS

Unit 1 : 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).

Unit 2 : 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, Fundamental equation of Physical Geodesy.


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

Unit 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

References
104- Introduction to IT

Unit 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 –

Unit 2 : Software Component - Software/Program - Operating System - Application Software/Program - Software for e-Governance

Unit 3 : Operating System: OS Functions - OS Services - Types of OS – Windows - Unix/Linux - Solaris - Real Time OS –


Text Books

References
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Unit IV : Map design, Symbolization and colors of patterns, Color gradients, Color type correlation, Point, line and polygon patterns map, Design concept layout of topographical maps, Basic elements of placement in maps. Map and legend and its importance in large layout map point line area.

Unit V : Thematic mapping- Cadastral maps, Topographical maps, Agricultural maps, Population maps, Cultural maps, Structural and statistical graphs related to data, Agricultural data, Pollution, Cultural and Cadastral data. Types of Graphs- Application of graphs for Geographical data.

Text Books

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

202- Digital Image Processing

Unit 1 : Principles: Data encoding and decoding - digital image formats - band sequential and band interleaved - characteristic features. software - raster and vector files
Unit 2 : Image Rectification and Restoration: geometric correction, radiometric correction -image enhancement: contrast manipulation - graylevel threshold, level slicing, and contrast stretching.


Text Books

References

203- Photogrammetry

Unit 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.
Unit 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.

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

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

Text Books
scans, 2nd edition, Walter de Gruyter, Germany
Photogrammetry, John Wiley and Sons, Inc.

References
Publishers.

204- Spatial Modeling & Analysis

Unit 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

Unit 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.

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

Unit 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.

Unit 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
Geographical Information Systems, Dorling Kinderseley (India) Pvt.
Ltd.
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
Delhi.
Geodatabase Design, Environmental Systems Research Institute,
Inc., Red Lands, California. USA- 92373-8100.
Geographical Patterns and Relationships, Environmental Systems
Research Institute, Inc., Red Lands, California. USA 92373 –8100

205- Digital Image Processing Lab
1. Geometric Correction
2. Radiometric correction
3. Histogram construction for digital data
5. Filtered outputs
6. Ratio images
7. Change detection analysis
8. Image classification based on digital values
9. Unsupervised classification
10. Supervised classification
206- Spatial Modeling & Analysis Lab
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.

Syllabus prescribed for M.Sc. Geoinformatics (Semester-III)
301- Research Methodology

Unit 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.

Unit 2 : Developing a Research Proposal: Format of research proposal-Individual research proposal-Institutional proposal-Hypothesis: Meaning-Types of hypothesis.

Unit 3 : Sampling: Sampling and Population, Techniques sampling selection, Characteristics of a good sample, Sampling errors and how to reduce them.

Unit 4 : Tools and Techniques of Data Collection: Checklist, Data schedule, Observation, Opinionative, Interview, Sociometric techniques, Questionnaire, Rating scales, Interview schedules.


Text Books
1. Research Methodology . Methods & Techniques : Kothari, C.R.

References

302- GIS Application Development

Unit 1 : Customization of GIS: Overview-programming for GIS applications - the expansion of GIS through customization and related capabilities - Automation of redundant processes - Data development/update automation - user tool development -

Unit 2 : Programming concepts: object-oriented concepts of applications component programming concepts - logic model - organizational understanding to logic modeling ,Research logic model elements - Develop simple, sample logic model

Unit 3 : Java Review: Write, debug and repair java code for GIS -Integration of code in GIS environment.

Unit 4 : Introduction to Arc Objects: Introduction to Arc GIS family of products-Programming Arc GIS using Arc Objects-understanding Component Object Model (COM)

Unit 5 : Components of Arc Object-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
References

303- Geoinformatics Applications in Natural Resources Management

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


Text Books

304- Geostatistics

Unit 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,

Unit 2: Random variables, Distribution functions and expectation: Introduction and summary, Cumulative distribution function, Density function, Expectations and moments.

Unit 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.

Unit 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.


Text Books

References
305 - Geostatistics (Lab)
Frequency distributions, Cumulative frequency distributions and
Frequency Curves, Mean, Median and Mode, Range, Variance
and Standard Deviation. Linear Correlation and Regression, Non-
Linear Regression - Multiple Correlation And Multiple Regression,
Factor and Factor analysis. Statistical Inference: Testing of
Hypothesis Parametric. Generation of PC1, PC2 and PC3 (Using
Statistical Software).

306 - Natural Resources and Management (Lab)
Interpretation of Satellite Images for Natural Resource Assessment
of Soil, Water and Land. Preparation of theme based map layers
and integration, classification using standard colour and symbol
codes. Generation of Natural resource maps for sustainable
management.

Syllabus prescribed for M.Sc. Geoinformatics (Semester-IV)

401- Database Management System

Unit 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.

Unit 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

Unit 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

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

Unit 5 : Emerging trends Object Oriented databases, Object
oriented queries Active databases Deductive databases

Text Books
1. Abraham Silberschatz; Henry F Korth, Database System Concepts,
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

402- Web Mapping and Web GIS

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

Unit 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

Unit 3 : Distributed geographic information services – principle –
components – logic and data components.

Unit 4 : Open Geospatial Consortium- Web Map Servers- WMS,-
interoperable systems and non-interoperable systems-
Web Feature Servers- Metadata standard, XML,
Geographic Markup Landguage -

Unit 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
403- Geoinformatics Applications in Agriculture


Unit 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.

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

Unit 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

References
2. Ron Lake, David S. Burggraf, Milan Trninic, Laurie Rae, 2004, Geography mark-up language (GML) John Wiley & Sons Ltd.

404- Geoinformatics Applications in Water Resources Management

Unit 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.

Unit 2 : 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.

Unit 3 : 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

Unit 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.

Unit 5 : Watershed management: Watershed- Drainage and water body mapping, morphometric analysis, classification, delineation and coding of watersheds, reservoir

Text Books

References
3. William Ripple, 1986, Geographic Information Systems for Resource $60.00 Management, ACSM.
sedimentation - watershed development planning, watershed prioritization, Watershed Information System; mapping drought-prone areas.

Text Books

References

405- Geoinformatics Applications to Agriculture and Watershed (Lab)


406- Project (Lab)

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.

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