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

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

अभ्यासक्रमिका
विज्ञान पारंगत सत्र-१ व २ परिक्षा २०१२-१३
विज्ञान पारंगत सत्र ३ व ४ परिक्षा २०१३-१४

PROSPECTUS

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

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I N D E X

M.Sc. (Geoinformatics) Prospectus No.20131237

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Syllabi prescribed for Master of Science in Geoinformatics

Semester-I to IV

Semester I

1. MGI -101 Principles 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)

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

101- Principles of Remote Sensing

Unit 1 : Fundamentals: Definition – Scope –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.

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 4 : Thermal Remote Sensing: thermal infrared radiation – thermal properties of materials – emissivity of materials – Thermal IR detection and imaging – characteristics of TIR images- applications.

Unit 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.

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 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.

Unit 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.

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

1. Heywood's, Comenius's and S. Carver (2006) An Introduction to Geographical Information Systems, Dorling Kindersley (India) Pvt. Ltd.
2. Burroughs 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.

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

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

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.

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 –

Unit 4 : Programming: Assemblers – Compilers – Interpreters - Machine Code - Assembly Language - High Level Languages - Systematic Programming - Object-Oriented Programming

Unit 5 : Computer Network: Communication Between Computers – LAN – WAN –INTERNET - World Wide Web - Repeater - Hub - Switch - Router - Gateway - Communication Protocols

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 (6th Edition), McGraw Hill, 2005

3. Gary Nutt, Operating Systems: A Modern Perspective, Pearson Education Asia 2nd Edition 2000.

105- Remote Sensing Lab

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

106- GIS Lab

1. Georeferencing scanned map
2. Creating layers; point, polyline and polygon
3. Managing Projection & Datum's
4. Managing attribute table
5. Managing Dimension; area and length
6. Symbolizing layers
9. Converting XY Data to GIS format
10. Designing Cartographic Output

Syllabus Prescribed for M.Sc. Geoinformatics (Semester-II)

201- Fundamentals of Cartography

Unit I : History of cartography (Ancient Period to Recent period), Terms and definition, Map projection, and references, spheroids, Map numbering system, Base map and Thematic maps, Map legend symbols and border information. Designing and layouts of the maps.

Unit II : Types of map- Small scale, medium scale and large scales maps. Choropleth map, Socioeconomic map, Water resources map, Geologic map, Forest map, Agriculture map, Water resource map, Water quality map, Soil survey map, Map for hot spots and Maps published the Survey of India.

Unit III : Scales and their functions and map projections. Graphics scale, Plain scales, Diagonal scale. Classification of projections, Choice of projections, Orthographic projections, Projections Lambeda. Mercator projection, Lambader cylindrical projections, Polyconic projections, Global projections, Conic projections, Definition, methods of representing scale.

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

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.

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.

Unit 3 : Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters : Smoothing – Sharpening filters – Homomorphic filtering. Principal components.

Unit 4 : Vegetation components - intensity - hue - saturation colour space transformation. Pattern Resolution: concepts - linear and non- linear discriminate function.

Unit 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.

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.

203- Photogrammetry

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

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

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

References

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

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 analysi 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

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

205- Digital Image Processing Lab

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

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.

Unit 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

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

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

303- Geoinformatics Applications in Natural Resources Management

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

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

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

Unit 4 : Water Resources: Surface water: precipitation – space time analysis – overland flow – storage – groundwater: potential – quality – layer creation – overlay analysis – integrated watershed development – case studies.

Unit 5 : 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.

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.

Unit 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

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

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 .

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

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.

403- Geoinformatics Applications in Agriculture

Unit 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 .

Unit 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.

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

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.

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

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.

405- Geoinformatics Applications to Agriculture and Watershed (Lab)

Spectro-radiometric Survey of agriculture crops. Determination of crop acerage from satellite images and image processing. Spectral signatures from spectro radiometer for water bodies. Analysis of Satellite Images for Drainage and WaterShed demarcation. Mapping Lithologically and Structurally Controlled delineation of Aquifer Systems. Preparation of theme based layers and integration for assessing agricultural and groundwater potential of the area.

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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