

# UNIVERSITY OF MADRAS



## M.Sc Degree Course in GEOINFORMATICS

(Under Private Study)

### *Syllabus*

### Semester Pattern (CBCS)

**UNIVERSITY OF MADRAS**  
DEPARTMENT OF GEOGRAPHY  
CHENNAI – 600 005

**UNIVERSITY OF MADRAS**  
**M.Sc. DEGREE COURSE IN GEOINFORMATICS**  
**(Under Private Study)**  
CBCS - Semester Pattern

**REGULATIONS**

**1. Introduction**

An Intensive Two-Year M.Sc Geoinformatics (Private study) at the Department of Geography, University of Madras is designed to provide the candidates a sound knowledge in the field of Geospatial technology for effective use of Geoinformatics in sustainable resource development planning. The course is designed for management level training for duration of two years. Upon completion of the course, participants should be able to contribute to the design, implementation and management of geoinformation production systems and quality control systems

**2. Objectives**

The main objective is to provide a comprehensive training in theory and practice in the field of Geoinformatics at the level of supervisors. After the completion of the Degree, the graduate should be capable of performing competently the routine tasks in the field of geoinformatics and capacity to supervise technicians in the routine tasks and relate to professionals in the planning and execution of Geoinformatics projects.

**3. Main Target Groups**

The course is mainly intended for those who are involved in the operational use of integrated geoinformation production and management in:

- National survey and mapping organisations, International organisations, United Nations etc
- Application oriented organizations (cadastre, local authorities, utilities companies, natural resources surveys, environment, private geoinformation production organizations),
- Private sector,(examples: Information technology industry, GIS consulting firms, Environmental management agencies, Tourist industry, Utility companies, E-commerce, Mineral exploration
- Emergency services, Public health and epidemiology, Planning and urban development, Crime mapping, Transportation and infrastructure
- And many more

**4. Eligibility for Admission**

A Candidate who has passed BA/BSc Degree Examination with Geography / Geology /Physics/ Environmental Sciences / Computer Science / Computer Applications/Information Technology/ Agriculture/Remote Sensing as the main subject of study or Geography as one of the subjects of study with knowledge of mathematics / statistics at least at the +2 level or BE Civil Engineering or any Information Technology related fields or an examination of any other University accepted by the syndicate as equivalent thereto.

Candidates with degrees in other subject areas will be considered if they can demonstrate interest, aptitude and experience in a field relevant to the application of geospatial technology.

**5. Duration of the Course**

The duration of the course is for two academic years consisting of FOUR semesters.

**6. Medium of Instruction: English**

### **7. Nature of the Programme**

The Course is a combination of lectures, demonstrations, seminars, practical and project workshops offered under Choice Based Credit System (CBCS). The course will be offered under Private Study at the Department of Geography, University of Madras.

### **8. Cost of the Programme and student Strength**

Course Fee for Indian students is Rs.50, 000/- (Fifty thousand only) for two years. Fees should be paid at the time of admission. For Foreign Students / NRI : US \$ 2,000 (Two Thousand only). Payment shall be made in two instalments (First year: 50%, Second year: 50%). Maximum student strength will be 100(*revised in 2012*).

### **9. Compulsory Intensive Contact Classes and Orientation**

Ten days of practical sessions including lectures and seminars will be conducted at the Department of Geography, University of Madras for each semester and the attendance is compulsory and a minimum of 80 percent of attendance to be gained by each candidate. For the examination purposes, the record works completed and duly signed at the intensive practical training along will be considered for examination. All practical exercises will be recorded in A4 size sheets and submitted for evaluation.

### **10. Project Work**

The MSc project is an extended piece of work carried out largely independently. At the end of the third semester, the title of the project work will be decided and approved for each candidate. A faculty member will be assigned as advisor. The topic for research project work within the fields of cartography, geographic information science, spatial planning, photogrammetric mapping, settlement studies, remote sensing, etc. will be selected by the student in consultation with the advisor. Students are encouraged to carry out projects in collaboration with industry, or in support of research projects in the Department of Geography/ Government departments/UN agencies. At the end of the project, students will have to present a seminar. The project report shall be submitted by the candidate before the commencement of the Second Year Examinations. Viva will be conducted at the Department of Geography, University of Madras, Chennai.

### **11. Eligibility for the Award of Degree**

A candidate shall be declared to have passed the examination if he/she obtains not less than 50 percent of the marks in each paper / practical / project. The candidate who does not obtain the required minimum marks for a pass in a paper(s) / practical / project shall be required to appear for and pass the same at a subsequent appearance. A candidate shall be eligible for the award of the degree only if he/she has undergone the full course of study for a period of not less than two academic years and pass the examinations in all the four semesters and earn the prescribed 91 credits.

All courses are standardised and the Credits for each course are in accordance with the hours of learning process, which includes lectures, labs or project work or presentation in the form of report or / record The subjects listed under each semester are compulsory courses in each semester.

### **12. Examination**

Examinations will be conducted at the end of each semester. The candidates who pass all the examination prescribed for the course in the first appearance only are eligible for ranking. Examination for theory, practical and Project work will be conducted by Department of Geography, University of Madras. Question Pattern will be set by the department. (*Revised in 2012*)

**M.Sc in GEOINFORMATICS**  
**(Under Private Study)**  
CBCS - Semester Pattern  
**Course for Study and Scheme of Examination**

**FIRST YEAR**

**First Semester**

Paper	Name of the Courses	Credits	Exam Hours	Marks
<b>I</b>	Fundamentals of Mapping and Mapping Science	<b>4</b>	<b>3</b>	<b>100</b>
<b>II</b>	Introduction to Information Systems and Database Management	<b>4</b>	<b>3</b>	<b>100</b>
<b>III</b>	Geographical Information Systems	<b>4</b>	<b>3</b>	<b>100</b>
<b>IV</b>	Surveying and Photogrammetry	<b>4</b>	<b>3</b>	<b>100</b>
<b>V</b>	Practical – I- Cartographic Techniques and Digital Mapping	<b>6</b>	<b>3</b>	<b>100</b> Exam 60 Record 40

**Second Semester**

Paper	Name of the Courses	Credits	Exam Hours	Marks
<b>VI</b>	Spatial Statistics and Mathematics	<b>4</b>	<b>3</b>	<b>100</b>
<b>VII</b>	Web Cartography and Geo-visualisation	<b>4</b>	<b>3</b>	<b>100</b>
<b>VIII</b>	Principles of Remote Sensing	<b>4</b>	<b>3</b>	<b>100</b>
<b>IX</b>	Spatial Modelling and Spatial Decision Making	<b>4</b>	<b>3</b>	<b>100</b>
<b>X</b>	Practical – II- GIS Analysis	<b>6</b>	<b>3</b>	<b>100</b> Exam 60 Record 40

**SECOND YEAR**

**Third Semester**

Paper	Name of the Courses	Credits	Exam Hours	Marks
<b>XI</b>	Introduction to Business and WebGIS	<b>4</b>	<b>3</b>	<b>100</b>
<b>XII</b>	Digital Image Processing and Image Interpretation	<b>4</b>	<b>3</b>	<b>100</b>
<b>XIII</b>	Geoinformatics for Natural Resources Management	<b>4</b>	<b>3</b>	<b>100</b>
<b>XIV</b>	Geoinformatics for Natural Hazards and Disaster Management	<b>4</b>	<b>3</b>	<b>100</b>
<b>XV</b>	Practical -III- Interpretation of Remotely sensed data and spatial modelling	<b>6</b>	<b>3</b>	<b>100</b> Exam 60 Record 40

**Fourth Semester**

Paper	Name of the Courses	Credits	Exam Hours	Marks
<b>XVI</b>	Research Methods and GIS Project Management	<b>4</b>	<b>3</b>	<b>100</b>
<b>XVII</b>	Geoinformatics for Business Planning and Management	<b>4</b>	<b>3</b>	<b>100</b>
<b>XVIII</b>	Geoinformatics for Urban Planning and Sustainability	<b>4</b>	<b>3</b>	<b>100</b>
<b>XIX</b>	Geoinformatics for Climate change and adaptation	<b>4</b>	<b>3</b>	<b>100</b>

<b>XX</b>	Research Project Work	<b>9</b>	(Report :60 Viva: 40) <b>100</b>
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## **M.Sc in GEOINFORMATICS** (Under Private Study)

### **FIRST YEAR**

#### **First Semester**

<b>Paper – I - Fundamentals of Mapping and Mapping Science</b>
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1. History and Development of Cartography: History and sequence of development, Computer and Cartography Information age and mapping, Web Cartography, Cartography as language and communication
2. Shape of the Earth and Coordinate Systems: Basic Geodesy, Geographical Data, Geographic Coordinates, Map projections-conformal and mathematical projections and properties, Scale, Reference and Plane Coordinate System
3. Data for Mapping, Compilation and Generalization: Survey methods, Remote Sensing, Global Positioning Systems Census and Sampling; compilation process, elements of generalisation, accuracy and reliability
4. Map Design and Symbolization: Map content, design and implementation, colour theory and pattern creation; feature attributes, point, line, areas and volumes; Qualitative and Quantitative symbols, Thematic Maps:
5. Layout and Map Production and Visualization: Map elements- typography and lettering; portraying land surface form; socio economic aspects map production and reproduction- Visualisation

#### **Text Books**

1. Robinson, A.H., J.L.Morrison, P.C., Muehrcke, A.J.Kimerling and S.C.Guptill (1995). Elements of Cartography, 6<sup>th</sup> Edition. New York., John Wiley & Sons. USA.
2. Misra, R.P. and A.Ramesh (1989). Fundamentals of Cartography, Concepts Publishing Company, New Delhi.
3. MacEachren, Alan, M., 1995, How Maps Work, Representation, Visualization and Design, Guilford Press

#### **References**

4. Kraak, M.J. and F.J.Ormeling (1996). Cartography : Visualisation of Spatial data, Longman Ltd., England.
5. Tyner, J. (1992). Introduction to Thematic Cartography, Prentice-Hall, Englewood Cliff, New Jersey.

#### **Web resources**

6. <http://www.fes.uwaterloo.ca/crs/geog165/cart.htm>
7. [http://www.colorado.edu/geography/gcraft/notes/cartocom/cartocom\\_ftoc.html#3.0](http://www.colorado.edu/geography/gcraft/notes/cartocom/cartocom_ftoc.html#3.0)
8. <http://www.earthsensing.com/cart/resources/carthelp.html>

<b>Paper – II - Introduction to Information Systems and Database Management</b>
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1. Information Technology: Meaning, scope and developments in information technology; Information technology firms: What they are and how they do things; Opportunities the IT industries offer.

2. Information Systems: Concepts and overview of information systems; A systematic framework for Information Systems; Components of information systems; Information systems design, analysis and management
3. Database Management Systems for Information Systems: Data resources, structure and functional aspects; graphic database, data storage and hypermedia; Data models
4. Internet and Information Management: Internet, Intranet, and Extranet; Electronic communication tools: electronic mail, e-conferencing, web-publishing and file transfers;
5. Information Systems – Management information systems: needs, design and action; library resource information systems; human information systems- Information decision support system: Knowledge-based search process; Artificial intelligence technologies: Artificial intelligences and Expert Systems.

### References

1. O'Brien, J.A. 1999: Management Information Systems, New York: Irwin-McGraw Hill.
2. Turban, E., R.K. Rainer Jr., and R.E. Potter 2000: Introduction to Information Technology, New Delhi: John Wiley.
3. Laurini, R. 2001: Information Systems for Urban Planning: A Hypermedia Co-operative Approach, London and New York: Taylor and Francis.

<b>Paper – III - Geographical Information Systems</b>
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1. Basic concepts of Spatial science and GIS: Geographic spaces, Spatial data and information, Reference systems and datums, GIS definition, Approaches and Components; History and Development of GIS
2. Data Models and Management: Spatial Data Models – Vector and Raster data models; Data Models – DBMS and GIS- data qualities
3. Data Capture and Geoprocessing: Sources of geographic data, capturing methods, topology, geometric Transformation, scales in GIS, precision and accuracy
4. Manipulation and Analysis: Basic spatial operations-vector and raster based point, line and area analysis; Digital Elevation Models
5. Geospatial Technology: GIS, Remote Sensing, GPS and Cartography for spatial modelling and applications

### Text Books

1. Ian Heywood, Sarah Cornelius and Steve Carver(2000),An Introduction to Geographical Information Systems, Addison Wesley Longman Limited, New York.
2. Aronoff, S. (1991) Geographic Information Systems: A Management Perspective, WDL Publications, Ottawa, Canada.
3. Dr. K. Elangovan (2006)GIS - Fundamentals, Applications and Implementations, New India Publishing Agency, New Delhi

## References

4. Kang-tsung Chang (2002) Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. David J Maguire, Michael F Goodchild, and David W Rhind ed.(1991) Geographical Information Systems, Longman Scientific & Technical Co-published in the USA with John Wiley & sons, Inc. New York.
6. Modeling Our World: The ESRI Guide to Geodatabase Design, by Michael Zeiler, ESRI Press, 1999, 216 pp., ISBN: 1879102625.
7. The ESRI Guide to GIS Analysis, by Andy Mitchell, ESRI Press, 1999, 188 pp., ISBN: 1879102064.

## Web Resources

1. <http://www.gsd.harvard.edu/pbcote/courses/gsd6322/lectures.htm>
2. [http://www.soi.city.ac.uk/~dk708/part\\_1.htm](http://www.soi.city.ac.uk/~dk708/part_1.htm)
3. [www.ncgia.ucsb.edu/education/curricula/giscc](http://www.ncgia.ucsb.edu/education/curricula/giscc)

<b>Paper – IV - Surveying and Photogrammetry</b>
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1. Introduction to surveying: principles of surveying – measurement technology – traditional survey methods – automated survey systems- GPS and its applications
2. History and development – types of aerial photo- classification of aerial cameras – optics for photogrammetry, camera calibration – photographic process.
3. Scale – overlaps – stereoscopy – concepts – viewing and measuring systems – image and object co-ordinates – floating mark – parallax equation – height information – Tilt – Rectification – Displacement-Flight planning – computation for flight plan – photo control – cost estimation – aerial mosaics – types.
4. Concepts of interior, relative, absolute orientation – object, image relation – linearization -effect of orientation elements – scaling and levelling – analytical procedures – map compilation using stereo plotters – Introduction to digital photogrammetry
5. GIS a Mapping tool : Photogrammetric applications - small scale versus large scale mapping - mapping and purposes

## References

1. Gottfried Konecny(2009), Geoinformation: Remote Sensing, Photogrammetry and Geographic Information Systems
2. Paul R.Wolf,(2001) Elements of Photogrammetry, McGraw-Hill Science
3. Edward M. Mikhail , James S. Bethel , J. Chris McGlone(2001), Introduction to Modern Photogrammetry ,Wiley
4. Ron Graham and Roger(2002), Manual of Aerial survey: primary data acquisition, CRC press

## Paper –V Practical – I- Cartographic Techniques and Digital Mapping

1. Map Appreciation and interpretation: Thematic, topographic and atlas maps- Mapping and Analysis : Relative relief and slope maps; height and hypsometric curves; stream Analysis
2. Climate and Hydrology: Climo and climatograph; rainfall variability intensity maps temperature and rainfall profiles; dispersion deviation graph ; aridity and water balance
3. Population and Economic Data Mapping: Dot maps, density maps-colour and grey scale patterns; index of concentration and diversification; transport network analysis
4. Quantitative Symbolisation and Location Maps: Located representation of tourism and facilities; point and line pattern analysis; cartograms and 3D maps
5. Scanning-Digitization - Map preparation -Database creation- Base map preparation- - Selection of geographical co-ordinates-Symbolization-Map Design and Layout using GIS software

### **References**

1. Monkhouse, F.J., and Wilkinson, H.R. (1976) : Maps and Diagrams, Methuen & Co., London.
2. Worthington, B.D.R. and Robert Gent (1975): Techniques in Map Analysis, Ebenzer Baylis and Sons, USA.
3. Anson, R.W. (Ed.) (1984) Basic Cartography for Students and Technicians, Volume 2, International Cartographic Association, Elsevier Applied Science Publishers, London.
4. Dorling, D. and David Fairbairn (1997), Mapping: Map of representing the world, Addisson Wesley Longman Ltd., U.K.
5. Lawrence, G.R.P. (1971). Cartographic Methods, Methuen & Co., Canada
6. Kang-tsung Chang (2002) Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing company Limited, New Delhi.

### **Web resources**

1. [www.sevenoaks.wa.edu.au/linkpage/geog/copy.html](http://www.sevenoaks.wa.edu.au/linkpage/geog/copy.html)
2. [www.gisdevelopment.net/books/mapping/bmap0010.htm](http://www.gisdevelopment.net/books/mapping/bmap0010.htm)
3. <http://www.esri.com/>



## **Second Semester**

### **Paper –VI - Spatial Statistics and Mathematics**

1. Nature of spatial data- Tables and graphs- scales of measurement and nature of data-statistical summaries- sampling procedures and probability distribution
2. Statistical Analysis: Basics of simple correlation and regression – hypothesis testing, parametric and non-parametric methods-regression, multiple regression and models – multivariate analysis – factor analysis and correspondent analysis
3. Basics Mathematics: Algebra, Matrix Algebra - Fundamentals and applications - Problems of simultaneous equations - Boolean algebra and set operations
4. Geographic data: Data cube - Spatial problems of sampling and data gathering - data collection by field methods - attribute data by socio-economic surveys - representing. univariate, bi-variate and multivariate data by maps.
5. Representing patterns: Class interval for mapping - natural break, equal interval and other methods - enhancement and generalisation principles - Mapping variations and residuals. Arithmetic and geometric distributions for mapping

#### **References**

1. Richard I. Levin and David S.Rubin (1996) Statistics for Management, Prentice- hall of India, New Delhi
2. Earl Gose and Richard Johnson Baugh and Steve Jost (1999) Pattern Recognition and Image Analysis, Prentice- hall of India, New Delhi
3. A.G.Wilson, M.J.Kirkby (1975); Mathematics for Geographers and Planners – Contemporary problems in Geography; Clarendon Press – oxford.
4. Arthur Getis, Barry Boots (1978); Models of spatial Process; Cambridge University Press, Cambridge.
5. Peter Hagget, Andrew D.Cliff and Allan Fray (vol.I & II) (1979); Locational Methods; Aronold – Heinemann Publishers, India.
6. George Simpson, & Fritz Kafka (1965); Basic Statistics; Oxford & IBH Publishing Co.

### **Paper –VII - Web Cartography and Geo-visualisation**

1. Web Cartography and GIS: New mapping environment-GIS and Web GIS and Animated maps-History of Internet and Web Mapping-Cartography and User Interface Design
2. Web map Publishing and Design: Basic publishing and web map functionality – web map design-colour-symbol-Virtual Reality and 3D Cartography
3. Advanced mapping environment: Web Atlases– maps and multimedia systems- animated maps and multi- dimensional display-Open GIS Web Mapping Activities- Internet Mapping and Distributed GIServices

4. Visual thinking and cyberspace: Visualization and exploratory data analysis-strategies- visualizing spatial data in the Web-spatial Visualization through Cartographic Animation
5. Web map and Decision Making: Web cartography and weather, road traffic and tourism - maps, GIS and the need for rule based cartography-on-line mapping resources and mapping – cartography and spatial information policy

## References

1. Menno-Jan Kraak and Allan Brown (Ed.) (2001) Web Cartography. Taylor & Francis, London
2. Menno-Jan Kraak and Ferjan Ormeling (1997) Cartography: Visualization of Cartography. Wesley Longman Limited, London
3. Earnshan, R. John Vince and HUW Jones, (1997). Visualization and Modelling, Academic Press, UK
4. Peng, Z.R. and Tsou, M.H. (2003). Internet GIS: distributed geographic information services for the Internet and wireless networks. New York: John Wiley and Sons, Inc.
5. MacEachren, A. M. & Kraak, M. (2001). Research Challenges in Geovisualization, Cartography and Geographic Information Science, Vol.28, No.1, 2001.

## Web Resources

6. <http://www.opengis.org/>
7. <http://map.sdsu.edu/gisbook>
8. <http://www.geovista.psu.edu/icavis/publications.html>

<b>Paper –VIII- Principles of Remote Sensing</b>
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1. Concepts of energy and radiation - principles, components of remote sensing systems, energy interactions, atmospheric windows; Interactions of earth surface features, spectral regions and principal methods of data acquisition, active and passive methods of sensing
2. Platforms, sensors, radiation records, format of photographic, digital imagery and non-imagery data, Data Products and Limitations; Photographic system of sensing; Satellite system of sensing
3. Sensors and sensing, optical mechanical and electronic sensor systems, microwave sensing, thermal scanning
4. Thermal and hyperspectral remote sensing: Sensors characteristics - principle of spectroscopy - imaging spectroscopy - field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing
5. Interpretation basics and methodology; *In-situ* support, collateral; Digital Image Processing; Classification and maps; Measurements and Instruments-Remote Sensing Applications in Natural Resources, land use/land cover analysis-settlement studies

## References

1. Paul. J. Gibson (2000) : Introductory Remote Sensing; Routledge; New York.
2. Lillesand and Keifer (2000) : Introduction to Remote sensing and Image Interpretation; John Willy & sons Ltd., New York.
3. James B. Campbell (1996); Introduction to Remote Sensing; Taylor & Francis, London.
4. Avery, T.E. and G.L. Berlin, (1992), Fundamentals of Remote Sensing and Air Photo Interpretation, Macmillan Publishing Company, New York.
5. Lillesand, T.M. & R.W.Kiefer (1987), Remote Sensing and Image Interpretation, John Wiley and Sons, Canada

<b>Paper –IX- Spatial Modelling and Spatial Decision Making</b>
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1. Digital Map Analysis: Concepts and Principles, spatial data handling and accuracy-, digital cartography and Boundary issues
2. Dynamic/Interactive Cartography, VRML, hyper maps, Open GIS: Implementation – generic and knowledge based mapping, Inter-operable and Entrepreneur GIS
3. Facility Management principles: Cost distances capacity and accessibility concepts and standards Single facility versus multiple facility location -Multi-criteria evaluation and decisions
4. Map algebra and spatial modelling - data driven and knowledge driven models, fuzzy logic for spatial analysis
5. Spatial information for modeling and decision making - multi-attribute and multi-objectives- Spatial decision support systems- development of DSS

## References

1. Ghosh, A. and G. Rushton (1987). Spatial analysis and Location-Allocation Models, van Nostrand Reinhold Company, New York..
2. Tomlin, C.D. (1990). Geographic Information Systems and Cartographic Modelling. Prentice Hall, Englewood Cliff, New Jersey
3. Worrall, L. (1991). GIS – Spatial Analysis and Spatial Policy using Geographic Information System, Belhaven Press, London.
4. Scholten, H.J. and J.C.H. Stillwell (1990) Geographical Information Systems for Urban and Regional Planning, Khewar Academic Publishers, The Netherlands
6. Densham, P.J. and G. Rushton, 1988. "Decision support systems for locational planning," in R. Golledge and H. Timmermans, editors, Behavioural Modelling in Geography and Planning. Croom-Helm, London.
7. Armstrong, M.P. and P.J. Densham, 1990. "Database organization alternatives for spatial decision support systems," International Journal of Geographical Information Systems, Vol 3(1): . Describes the advantages of the extended network model for network-based problems.

## Paper –X- Practical – II- GIS Analysis

1. Digitization – creation of spatial data- Point, Line, Polygon features -Building topology – geo-referencing-measuring distance and area
2. Attribute data editing and integration, class interval selection, thematic mapping and output-labelling
3. Buffering, Overlay and Network analysis- 3D Analysis - TIN and DEM
4. Spatial interpolation- Thematic mapping-located bar diagrams
5. Ground truth support: Use of GPS for siting and routing; GPS with field data attributes

### **Text books**

1. Ian Heywood, Sarah Cornelius and Steve Carver (2000), An Introduction to Geographical Information Systems, Addison Wesley Longman Limited, New York.
2. Aronoff, S. (1991) Geographic Information Systems: A Management Perspective, WDL Publications, Ottawa, Canada.

### **References**

3. Kang-tsung Chang (2002) Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing company Limited, New Delhi.
4. Chrisman, N. (1997) : Exploring Geographic Information systems, New York : John Wiley & Sons., Inc.

### **Web Resources**

4. [www.ncgia.ucsb.edu/education/curricula/giscc](http://www.ncgia.ucsb.edu/education/curricula/giscc)
5. <http://www.esri.com/>

## SECOND YEAR

### Third Semester

<b>Paper –XI- Introduction to Business and WebGIS</b>
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1. GIS capabilities, uses and implementation: Private GIS use – GIS enterprise and internal organisational management – GIS public resource management system – Decision Support and GIS.
2. Data Business: Spatial data generation for industry and business – data business for government – public data for awareness and utilities – attribute data in GIS business – Data minimizing and warehousing activities.
3. Industry applications: property development and real estate – minimizing and ore based industries – land capability and water resource management – whole sale and retail trade outlets – Institutional training and NGO activities- trade and tourist information
4. Public Interest advice: Insurance cover and natural hazards – insurance occupation and urban living – disease and health care – travel plan and query – social facilities.
5. Cartographer and consultant: Remote Sensing, spatial data analysis and modelling – map designing and printing – property development – e-governance – EIA – Web GIS.

### References

1. Gilbert H. Castle (Ed.) 1993. Profiting from a GIS, GIS world books, Post Colliz, USA
2. Keith R.McCloy (1995). Resource management Info Sys. Taylor and Francis, London.
3. Donna J. Peuguet and Duane, I. Marble (ed.) (1990). Taylor & Francis, London.

<b>Paper –XII- Digital Image Processing and Image Interpretation</b>
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1. Image Processing Overview: data acquisition, processing / analysis and output concepts and components; Statistical and mathematical foundations: matrix algebra and its applications – probability theory, sampling, estimation and interpolation / extrapolation principles.
2. Decision making principles: parametric and non-parametric decision, Window and Kernel estimators, classification and clustering principles; Digital Image Processing System: an overview of hardware and software, processing principles.
3. Data acquisition and digital image format; Pre-processing: enhancement, contrast manipulation, density slicing, and color coding; Image Rectification: noise, removal, spectral, radiometric and geometric corrections
4. Unsupervised classification' filtering, generalisation and thematic map extraction; Supervised classification: training sites, classifiers accuracy of estimates; in-situ support: field data collection, equipment in field data collection – radiometers and GPS
5. Data Interpretation: concepts of GIS, map, remote sensing, field work and attribute data integration; Post classification task: design and layout principles, map output.

## References

1. Gose, E., R.Johnsonbaugh and S.Jost (1997). Pattern Recognition and Image Analysis". Prentice Hall Pvt. Ltd. New Delhi.
2. Gonzalaz, R.C. and P.Wintz (1987) "Digital Image Processing", Addition-Wesley Reading, Mass. USA
3. Jain, A.K. (1989). "Fundamentals of Digital Image Processing", Prentice Hall India Pvt. Ltd., New Delhi, India.
4. Santanr Chaudhury, Shree K. Nayar (1999); Computer vision, Graphics and Image processing; Viva Books Pvt., Ltd., New Delhi.
5. Miland Sonka, Vaclaw Hlavac, Roger Boyle (1999); Image processing, Analysis and Machine vision –Earl Gose; PWS Publishing., New York.
6. Richard Johnson bough, steve jost (1999); Pattern Recognition and Image analysis; Prentice, Hall of India Pvt Ltd., New Delhi.

<b>Paper –XIII- Geoinformatics for Natural Resources Management</b>
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1. Introduction to Resources: Concepts, classification and appraisal- Natural resources – natural resource economics - management of natural resources: government–other agencies
2. Resource Assessment-I : Land evaluation methods- land classification methods-soil and water conservation- land use and Land cover mapping- land use planning and development
3. Resource Assessment-II: Water resource assessment- watershed analysis and management-coastal and ocean resources and management- fisheries management
4. Risk assessment: Wildlife, forest, recreational, agricultural and rangeland assessment - Ecological Risk Assessments - Natural Resource Damage Assessments- damage of natural resources
5. Remote sensing and GIS applications: natural resource surveys and monitoring–strategies for natural resource management- millennium eco-system assessment project-resources utilization and conservation in India.

## References

1. Holechek, J. L., R. A. Cole, J. T. Fisher, and R. Valdez (2003) Natural Resources: Ecology, Economics and Policy (2<sup>nd</sup> Edition). Prentice Hall Education.
2. Knight, Richard L., and Sarah F. Bates (1995). A New Century for Natural Resource Management. Island Press Publishing.
3. Lilesand and Keifer (2000) : Introduction to Remote sensing and Image Interpretation; John Willy & sons Ltd., New York
4. Colin W.Mitchell (1991) Land Evaluation, Longman scientific& Technical, copublished with John Wiley & sons Inc, New York.
5. Burrough, P.A. (1986). Principles of Geographical Information Systems for Land Resource Assessment, Clarendon Press, Oxford, New York.

## **Paper –XIV- Geoinformatics for Natural Hazards and Disaster Management**

1. Introduction to natural hazards, risks and vulnerabilities - ethical and legal considerations for governments, businesses, non profit organizations and the community:
2. Identifying risks, hazards and vulnerabilities risk/hazard/vulnerability estimation, and assignment of priorities – Survey and assessment tools and methodologies
3. GIS, Remote sensing, GPS and other tools for hazard, risk and vulnerability assessment- Field vulnerability assessments- UN procedures
4. Emergency Management: Special tasks of risk/vulnerability assessments: medical, veterinary, business/industrial, education, local government
5. Disaster Management: Identification and examination of options to deal with risk and vulnerabilities and disaster management- Case studies

### **References**

1. FEMA (2002) Are You Ready? Your Guide to Disaster Preparedness, Federal Emergency Management agency, Washington, DC (available on-line)
2. NFPA 1600 Standard on Disaster Emergency Management and Business Continuity Programms 2000 Edition, Technical Committee on Disaster Management, National Fire Protection Association, Quincy, MA: NFPA.
3. Sisi zlatanova & Andrea Fabbri jonathanli, Geometrics solutions for Disaster management, Springer Verlag, 2007.
4. C.Emdad Haque, Mitigation of natural Hazards & disasters, Kluwer Academic publishers group, 2005.
5. Linda C. Bottersll & ponald A.wilhite, From Disaster response to Risk management. Kluwer Academic publishers group, 2005.

## **Paper –XV- Practical -III- Interpretation of Remotely sensed data and spatial modelling**

1. Spectral reflectance Profiles, features and wavelength regions; Interpretation of Photomorphic / image products: use of black/white, color, FCC, thermal, radar images.
2. Geometrical characteristics: scale and projection; Use of Instruments and equipment: stereoscopes, planimeter, stereometer and interpretation equipment.
3. Digital Image Manipulation: Raster data: display' enhancement and filters; Raster map: overlay analysis and multi-image manipulation; Bit map studies and training sites; Supervised and unsupervised classification
4. Statistical Mapping: Graphs z scores, index construction, correlation, regression and residuals.
5. Map modelling and geospatial analysis

## References

1. Dury, G.H. (1952). Map Interpretation. Sir Issac Pitman & Sons., Ltd., UK
2. Jensen, J.R. (1996). "Introductory Digital Image Processing, Prentice Hall. New Jersey.
3. MapInfo Professional Users Guide (1995). MapInfo Corporation, New York.

## Fourth Semester

<b>Paper –XVI- Research Methods and GIS Project Management</b>
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1. Meaning of accounting for spatial variations – establishing laws and theories in geography - nature and function of Theories, Models -meaning of model- multiple variable Linear Models – procedure for developing Models, Measurement and Statistics
2. Spatial manifestations of choice process – locations and migrations; gaming simulation as a mechanism for illustrating the process of locational decision making – spatial choice process and migration decisions
3. Research Design and Qualitative and Quantitative Techniques in GIS research projects and implementation
4. Current and potential approaches to GIS project management-GIS and related spatial technologies in selected applications.-GIS data handling and spatial analysis
5. Diverse of application areas : business, health and social services, the environment, municipalities- GIS data handling and spatial-analysis

## References

1. Douglas Amedeo and Reginald G.Golledge (1975), An introduction to scientific reasoning in geography, John Wiley & Sons Inc. Newyork.
2. Birkin, M., Clarke, G., Clarke, M. and Wilson, A. (1996) Intelligent GIS: Location Decisions and Strategic Planning. GeoInformation International.
3. Chainey, S., and J. Ratcliffe, 2005, GIS and crime mapping, Chichester, West Sussex, England ; Hoboken, NJ : Wiley & Sons
4. Chang, Kang-Tsung, 2004, Introduction to geographic information systems, McGraw-Hill, Boston, 400p.
5. Church,R., and A. Murray, 2009, Business site selection, location analysis, and GIS, Hoboken, N.J. : John Wiley & Sons
6. Clarke, G., and Stillwell, J., Ed), 2004, Applied GIS and spatial analysis, John Wiley, Hoboken, NJ, 406p.
7. Cope M. and S. Elwood, 2009, Qualitative GIS: a mixed methods approach, Los Angeles ; London : SAGE
8. Douglas, B., 2008, Achieving business success with GIS, Chichester, England ; Hoboken, NJ : Wiley
9. Tomlinson, R. (2003) Thinking about GIS: Geographic Information System Planning for Managers. ESRI Press, Redlands, CA.



## **Paper –XVII- Geoinformatics for Business Planning and Management**

1. Applied Geoinformatics: Business technology-Applied GIS and Geography – Diverse data sources in practice for business and geographical integration.
2. Customer targeting–Marketing spatial analysis – applied spatial analysis and marketing – emerging new marketing technology.
3. Implementing spatial analysis for business and service planning – modifiable area unit problem – spatial auto-correlation – current general purposes commercial GIS.
4. Customized Spatial Decision Support System – Intelligent GIS – Optimal Business strategies for a region – spatial investment decision
5. Business geographics – Business, geography and Geoinformatics – case studies – banking, retails, insurance, telecommunication and real estate

### **References**

1. Gilbert H. Castle (Ed.) 1993. Profiting from a GIS, GIS world books, Post Colliz, USA
2. Keith R.McCloy (1995). Resource management Info Sys. Taylor and Francis, London.
3. Paul Longley and Graham Clarke ed. (1995) GIS for Business and Service Planning ,John Wiley & Sons, Inc, New York,USA

## **Paper –XVIII - Geoinformatics for Urban Planning and Sustainability**

1. Sustainability Planning – Theory and background – current urban problems and opportunities – definition and perspective on sustainability
2. Environment Economics and Equities –social sustainability - Ethics, World views and sustainability
3. Tools for sustainability planning – indicators ecological foot print – Tools for community sustainability – Municipal planning and sustainability
4. Planning for Sustainability for different scales – regional planning sustainability – transportation planning – New urbanization and smart growth
5. Urban ecology and sustainability – Sustainable water use – urban areas, parks, public spaces and biological diversity- Neighbourhood planning and sustainability

### **References:**

1. Adams, W.M. 1990. Green Development: Environment and Sustainability in the Third World, New York: Routledge. A good history of the origins of the sustainability concept, going back to the 19th century, from a strongly international perspective. Sharply critical of the Brundtland outlook.
2. Beatley, Timothy and Kristy Manning. 1997. The Ecology of Place: Planning for Environment, Economy, and Community. Washington, D.C.: Island Press. An excellent overview of sustainable city issues.

3. Beatley, Timothy. 2000. Green Urbanism: Learning from European Cities. Washington, D.C.: Island Press. A survey of sustainability-related initiatives in Europe.
4. Brown, Lester R. 1981. Building a Sustainable Society. New York: Norton. One of the earliest overviews of potential sustainability policies, by the founder of the World watch Institute.

<b>Paper –XIX - Geoinformatics for Climate Change and Adaptation</b>
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1. Introduction to climate change – Climate change is a geographic problem- mitigation and adaptation – change in eco-systems
2. Assessment of Climate change Impact on Economy – economic issues – socio economic changes scenario –climate change scenario
3. Assessment of Climate Change Impact in Agriculture and Forestry - mitigation role of agriculture and forest – greenhouse gas sinks
4. Human adaptation to climatic variability and change – vulnerability and resilience – adaptation and disaster risk –
5. Climate change case studies – effects of climate change – land use and land use planning-GIS for climate change –GIS based Action Plan - decision making, and application to climate science- comprehensive climate information system

#### **References**

1. Elizabeth Kolbert, (2006) Field Notes from A Catastrophe: Man, Nature and Climate Change, Bloomsbury Publishing Plc.
2. E.Lisa F. Schipper and Ian Burton (Ed.) (2008) Adaptation to climate Change, Earthscan Reader Series, pp480

<b>Paper –XX - Research Project Work</b>
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The topic for research project work will be selected in consultation with the supervisor from cartography, geographic information science, photogrammetric mapping, remote sensing, etc. Students will present a seminar on their dissertation.