



UNIVERSITY OF MADRAS

# M.Sc. GEOINFORMATICS

*(Under Private Study)*



Organised by

**DEPARTMENT OF GEOGRAPHY  
SCHOOL OF EARTH AND ATMOSPHERIC SCIENCES  
UNIVERSITY OF MADRAS**

**DEPARTMENT OF GEOGRAPHY  
UNIVERSITY OF MADRAS  
M.Sc. DEGREE COURSE IN GEOINFORMATICS**

(Under Private Study)  
CBCS - Semester Pattern  
(With effect from the academic year 2018-2019 onwards)

**REVISED REGULATIONS**

## **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

## **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.

### **1. 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

## 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.

## DURATION OF THE COURSE

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

## 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.

## 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*).

## 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.

## PROJECT WORK

The M.Sc. 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.

## 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.

**MSc in Geoinformatics:** To be eligible for the award of MSc, the student must successfully complete all the four semesters.

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.

## 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.

## LAST DATE FOR APPLICATION

**The last date for application has been extended till 15.11.2018**

## FOR ADDITIONAL INFORMATION

**Dr. R. Jaganathan**

Professor and Head

Department of Geography

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**MSC. GEOINFORMATICS**  
(Under Private Study)  
CBCS - Semester Pattern

**Course for Study and Scheme of Examination**

Subject Code	Name of the Courses	Credits	Exam Hours	Marks
<b>First Semester</b>				
PRIC001	Spatial Data Science and Applications	4	3	100
PRIC002	Principles of Cartography	4	3	100
PRIC003	Information Systems and Database Management	4	3	100
PRIC004	Surveying and Photogrammetry	4	3	100
PRIC005	Practical – I: Techniques of Mapping and map Analysis (Exam 60; Record 40)	6	3	100
<b>Second Semester</b>				
PRIC006	Geographical Information System	4	3	100
PRIC007	Geostatistics	4	3	100
PRIC008	Geoinformatics for Business Planning and Management	4	3	100
PRIC009	Field Survey Techniques (Field work)	4	3	100
PRIC010	Practical-II: GIS (Exam 60; Record 40)	6	3	100
<b>Third Semester</b>				
PRIC011	Satellite Remote Sensing	4	3	100
PRIC012	Cloud computing and GIS	4	3	100
PRIC013	Spatial Modelling and Spatial Decision Making	4	3	100
PRIC014	Geoinformatics for Natural Hazards and Disaster Management	4	3	100
PRIC015	Practical -III- Remote Sensing (Exam 60; Record 40)	6	3	100
<b>Fourth Semester</b>				
PRIC016	GIS Project Management	4	3	100
PRIC017	Geoinformatics for Watershed Management	4	3	100
PRIC018	Geoinformatics for Urban Planning and Sustainability	4	3	100
PRIC019	Geoinformatics for Climate change and adaptation	4	3	100
PRIC020	Research Project Work (Report 60; Viva voce 40)	9		100



**M.Sc. in GEOINFORMATICS**  
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**I SEMESTER**

**PRIC001 - SPATIAL DATA SCIENCE AND APPLICATIONS**

1. Understanding Spatial Data Science - spatial data science in comparison with science, data science, and spatial data science- what is spatial special- spatial data science from perspectives of business, technology, and data.
2. Solution Structures of Spatial Data Science Problems-subject matter- software tools, and their combinations for the solution structures of spatial data science problems-GIS, DBMS, Data Analytics, and Big Data Systems- Geovisualization and Information Delivery
3. Spatial DBMS and Big Data Systems- DBMS - Spatial DBMS - Big Data Systems and the current paradigm – MapReduce - Hadoop MapReduce, Hadoop Distributed File System (HDFS), Hadoop YARN, - Spatial Hadoop and GIS Tools for Hadoop, and review their pros and cons for spatial big data management and processing.
4. Spatial Data Analytics- spatial analysis methods - Proximity and Accessibility- business applications- trade area analysis, Floating Catchment Analysis (FCA), Gravity-based index of accessibility- Spatial Interpolation- Spatial Categorization-Hotspot Analysis-Network Analysis
5. Practical Applications of Spatial Data Science- basic geospatial intelligence knowledge and related practical skills that assist in informing decision-making

**References**

1. Banerjee, S., Carlin, B. P., & Gelfand, A. E. (2014). Hierarchical modeling and analysis for spatial data. Crc Press.
2. Billinge, M., Gregory, D., & Martin, R. (1983). Recollections of a revolution: geography as spatial science.
3. Cressie, N. (2015). Statistics for spatial data. John Wiley & Sons.
4. Fotheringham, S., & Rogerson, P. (Eds.). (2013). Spatial analysis and GIS. CRC Press.
5. Haining, R. (1993). Spatial data analysis in the social and environmental sciences. Cambridge University Press.
6. Karimi, H. A. (Ed.). (2014). Big data: Techniques and technologies in geoinformatics. CRC Press.
7. Miller, H. J., & Han, J. (Eds.). (2009). Geographic data mining and knowledge discovery. CRC Press.
8. Pedrycz, W., & Chen, S. M. (Eds.). (2014). Information granularity, big data, and computational intelligence (Vol. 8). Springer.

## PRIC002 - PRINCIPLES OF CARTOGRAPHY

1. History and future of cartography - Information age and mapping, Cartography as language and communication -Visual Thinking and Visual Communication-spatial information system
2. Geodesy, Coordinate Systems, and map projections- Geographical Data, accuracy and reliability
3. Compilation process-Scale, and Generalization- Levels of Data Measurement-Cartographic design principles- role of human perception in map use and map design- map symbolization- Qualitative and Quantitative symbols -graphic communication
4. Layout and Display-Map elements- Typography & Labeling- Thematic Map Forms- Geovisualizations- Visualizing Terrain, Animation, - Isarithmic & Surface Mapping-Map Reproduction, Publishing, & Sharing
5. e-mapping, online map data sources-Geospatial web services-Dynamic/Interactive Mapping-cartography and spatial information policy

### References

1. Brewer, C. A. 2005. Designing Better Maps. Redlands, CA: ESRI Press. (ISBN 1-58948-089-9)
2. Dent, B.D., Torguson, J.S. and Hodler, T.W. 2009. Cartography: Thematic Map Design. Boston: McGraw-Hill. 6th edition. (ISBN: 978-0-07-294382-5)
3. Jennings, Ken. (2011). Maphead: Charting the Wide, Weird World of Geography Wonks. New York: Scribner
4. MacEachren, Alan, M., 1995, How Maps Work, Representation, Visualization and Design, Guilford Press
5. Misra, R.P. and A.Ramesh (1989). Fundamentals of Cartography, Concepts Publishing Company, New Delhi.
6. 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.
7. Tyner, J.A. (2014) Principles of Map Design. New York, NY: Guilford Press.

## PRIC003 - INFORMATION SYSTEMS AND DATABASE MANAGEMENT

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. (2004). Management Information Systems W/E-Tutor & McGraw-Hill.
2. O'Brien, J. A., & Marakas, G. M. (2005). Introduction to information systems (Vol. 13). New York City, USA: McGraw-Hill/Irwin.
3. Ramakrishnan, R., & Gehrke, J. (2000). Database management systems. McGraw Hill.
4. Devlin, B., & Cote, L. D. (1996). Data warehouse: from architecture to implementation. Addison-Wesley Longman Publishing Co., Inc.
5. Laurini, R. (2001), Information Systems for Urban Planning: A Hypermedia Co-operative Approach, London and New York: Taylor and Francis.
6. Turban, E., R.K. Rainer Jr., and R.E. Potter 2000: Introduction to Information Technology, New Delhi: John Wiley.



## **PRIC004 - SURVEYING AND PHOTOGRAMMETRY**

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

## **PRIC005 – PRACTICAL - I: TECHNIQUES OF MAPPING AND MAP ANALYSIS**

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; Crop combination technique, Spatial interaction, Measures of 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. Thematic map forms- statistical maps- web maps

### **References**

1. Ramamurthy, K. (19 82): Map Interpretation, Rex Printer, Madras
2. Tamaskar, B. G. and Deshnnikh, V. M. (1974): Geographical Interpretation of Indian Topographical maps. Orient Longman
3. Monkhouse, F.J., and Wilkinson, H.R. (1976) : Maps and Diagrams, Methuen & Co., London.
4. Worthington, B.D.R. and Robert Gent (1975): Techniques in Map Analysis, Ebenzer Baylis and Sons, USA.
5. Jones, P. A. (1968): Field work in Geography, Longman, London
6. Archer, J.E and Dalton, T. H. (1968): Field Work in Geography, E. T. Bastsford Ltd.,London
7. Hinde, A. (Dorling, D. and David Fairbairn (1997), Mapping: Map of representing the world, Addisson Wesley Longman Ltd., U.K.
8. Lawrence, G.R.P. (1971). Cartographic Methods, Methuen & Co., Canada
9. Yeats, M. H. (1978): An introduction to quantitative analysis in human geography
10. King, C. A.M (1966): Techniques in Geomorphology, Edward Arnold, London
11. Miller, Austin (1953): The skin of the Earth, Methuen & Co. Ltd. London
12. Liendsor, J. M. (1997): Techniques in Human Geography, Routledge.
13. Lloyd, P. and B. Dicken (1972): Location in Space - A theoretical approach to economic geography. Harper and Row, New York

## II SEMESTER

### PRIC006 - GEOGRAPHICAL INFORMATION SYSTEM

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. Spatial operations: Basic operations - buffer, overlay, network, view shed analysis, interpolation, 3D visualization
5. GIS modeling – multi-criteria analysis – network applications – LBS – geocoding - suitability modelling – location allocation modeling - applications and case studies

#### 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.

## PRIC007 – GEOSTATISTICS

1. Geostatistics- simple correlation and regression – hypothesis testing, parametric and non-parametric methods-regression, multiple regression and models – multivariate analysis – factor analysis and correspondent analysis - Applied statistics for map analysis
2. Data cube - Spatial problems of sampling and spatial data collection by field methods - attribute data by socio-economic surveys - representing. Univariate, bi-variate and multivariate data by maps.
3. Representing patterns: Class interval for mapping - Mapping variations and residuals. Arithmetic and geometric distributions for mapping- Geostatistics: interpolation
4. Space and time, spatial analysis and planning; Spatial locations: spatial facility planning- aggregation and distribution principles, central facilities, noxious locations- Location allocation strategies and GIS
5. Spatial partitions and districting; Spatial interaction: principles, variations and consequences -Locational planning problems: - Single locations, P-median problems; Allocation Problems and Methodology; and use analysis and decision making

### References

1. Gatrell, A.C. (1983). Distance and space. A Geographical Perspective, Clarendon Press, Oxford.
2. Scott, A.J. (1971). Combinatorial Programming. Spatial Analysis and Planning, Methun & Co. Ltd. London.
3. Bonini, C.P., W.H.Haausman, and H.Bierman, J. (1997). Quantitative Analysis for Management, The McGraw Hill Co. USA.
4. Massam, B.H. (1980). "Spatial Search". Pergamon Press. Oxford.
5. A.G.Wilson, M.J.Kirkby (1975); Mathematics for Geographers and Planners – Contemporary problems in Geography; Clarendon Press – oxford.
6. Arthur Getis, Barry Boots (1978); Models of spatial Process; Cambridge University Press, Cambridge.
7. Peter Hagget, Andrew D.Cliff and Allan Fray (vol.I & II) (1979); Locational Methods; Aronold – Heinemann Publishers, India.
8. George Simpson, & Fritz Kafka (1965); Basic Statistics; Oxford & IBH Publishing Co.

## **PRIC008 - 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 Geoinfomatics – 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

## **PRIC009 - FIELD SURVEY TECHNIQUES**

This course work contains - Plan and schedule of the work carried out and comprehensive report on the field work. The Student should prepare an individual report based on primary and secondary data collected during field work. Field and digital techniques for map making including use of GIS, GPS, and digital tablets. The maximum length of the report should not exceed 12000 words, excluding figures, tables, photographs, maps, references and appendices

The students will go for a field work in the Second and Fourth semester, which is compulsory and on the basis of that, each student has to submit a field work report as part of the second and fourth semester course work. Each report must be accompanied by field notebook, a fair copy of map, related cross sections and other relevant documents.

Assessment: 10% for Field Conduct, 20% for Field Participation and Exercises: 20% for Field Notes: 50% for Final Report



## PRIC010 – PRACTICAL-II: GIS

1. Map exploration - Georeferencing – map projection and transformation – spatial entity creation – digitization – symbolization - attribute data editing – labelling and annotation – map design and layout - Editing and topology: building topology, topology error rectification – edge matching – rubber sheeting.
2. Attribute data management and thematic mapping: quantitative and qualitative mapping, dot map, located pie chart and bar chart – Proximity analysis – overlay analysis - Geotagged photographs.
3. Network analysis – Geocoding - location and allocation models; spatial statistics: Measurement- Mean Center, Median Center, Standard Distance
4. Surface analysis and Interpolation techniques: Creation of Contours, Slope, Aspect, Kriging, Spline, Inverse Distance Weighted (IDW) – 3D visualization: DEM, TIN.
5. Ground truth support: GPS with field data attributes - Suitability analysis and modelling: habitat suitability – house hunting – noise pollution modelling – hydrological modelling

### 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

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

### III SEMESTER

#### PRIC011 - SATELLITE REMOTE SENSING

1. Introduction, development of remote sensing technology- principles, components of remote sensing systems- Different platforms of remote sensing-EM spectrum, solar reflection and thermal emission.
2. Concepts of energy and radiation - energy interactions - Interactions of earth surface features, spectral regions and principal methods of data acquisition - active and passive methods of sensing- concepts of resolutions- Platforms, sensors, radiation records
3. Digital imagery and non-imagery data, Data Products and Limitations - Photographic system of sensing, elements of Photogrammetry, Photographic techniques in aerial and space borne remote sensing; Spectrozonal photography using various camera, film, filter combinations; Applications and limitations- Satellite system of sensing
4. Sensors and sensing, optical mechanical and electronic sensor systems, microwave sensing, thermal scanning - Interpretation basics and methodology - Stereo aerial photography, principle of stereoscopy, Principles of image interpretation, digital image processing
5. Multi-spectral scanners and imaging devices; Salient characteristics of LANDSAT, IRS, SPOT, IKONOS, Quick Bird, GeoEye sensors and their applications- PS surveying- field work data collection- location information- distance measurement-resource mapping and analysis.

#### References

1. Qihao Weng 2011 'Advances in Environmental Remote Sensing: Sensors, Algorithms, and Applications Remote Sensing Applications Series' CRC Press, 2011.
2. Liang Shunlin 2017 'Comprehensive Remote Sensing' Elsevier
3. Cracknell Arthur. P 1991 'Introduction to Remote Sensing, Second Edition' CRC Press.
4. Joseph George 2005 'Fundamentals of Remote Sensing' Universities Press.
5. James B. Campbell (1996) ; Introduction to Remote Sensing; Taylor & Francis, London
6. Lillesand and Keifer (2000) : Introduction to Remote sensing and Image Interpretation; John Willy & sons Ltd., New York.
7. Lillesand, T.M. & R.W.Kiefer (1987), Remote Sensing and Image Interpretation, John Wiley and Sons, Canada
8. Paul. J. Gibson (2000): Introductory Remote Sensing; Routledge; New York.
9. Eugene Avery Thomas & Berlin Graydon Lennis 1992 'Fundamentals of Remote Sensing and Airphoto Interpretation' Macmillan,
10. Nag Prithvish 1992 'Thematic Cartography and Remote Sensing 'Concept Publishing Company

## PRIC012 - CLOUD COMPUTING AND GIS

1. Introduction to cloud computing: Key characteristics. Emerging trends in cloud - benefits – online data sharing – communication – web application – WebGIS vs desktop GIS– internet and connectivity issues.
2. Cloud service modules IaaS, PaaS, SaaS and GIS integration - Private, public and hybrid cloud - public vs private clouds services and cloud architecture – components of cloud computing
3. GIS cloud and web interface - application and technology infrastructure in cloud– GIS cloud service providers – online mapping applications. Internet technologies for cloud computing.
4. CloudGIS Communication: GIS servers - integration – client - data sharing technology and web services – OGC in cloud - security issues – cloud storage service providers.
5. Cloud application development platforms: GIS map engine, Amazon, Azure, Google App.

### References

1. Gautam Shroff (2010) “Enterprise Cloud Computing Technology Architecture Applications”, Cambridge University Press; 1<sup>st</sup> edition, ISBN: 978-0521137355.
2. Toby Velte, Anthony Velte, Robert Elsenpeter (2009) Cloud Computing, A Practical Approach” McGraw-Hill Osborne Media; 1<sup>st</sup> edition, ISBN: 0071626948.
3. Tereshenkov, 2009. A. Web GIS Application in Local Government, VDM Verlag.
4. Kraak, M. and Brown, 2001. A. Web Cartography: Development and Prospects, Taylor and Francis, London.

### Web resources:

5. <http://www.esri.com/news/arcwatch/0110/feature.html>
6. <https://www.gislounge.com/learn-about-gis-in-the-cloud/>
7. <https://www.geospatialworld.net/article/cloud-computing-future-belongs-to-gis-as-a-service/>

## **PRIC013 - SPATIAL MODELLING AND SPATIAL DECISION MAKING**

1. Concepts and Principles of spatial science, spatial data handling and accuracy, digital cartography
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
5. 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.
6. 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.

## **PRIC014 - 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.

## **PRIC015 PRACTICAL -III- REMOTE SENSING**

1. Spectral reflectance Profiles, features and wavelength regions; Interpretation of Photomorphoc / 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.



## IV SEMESTER

### PRIC016 - GIS PROJECT MANAGEMENT

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.

## **PRIC017 - GEOINFORMATICS FOR WATERSHED MANAGEMENT**

1. Watershed: Philosophy and Concept of Watershed - Delineation and codification of watershed – Watersheds and administrative decisions.
2. Structure and functions: Geomorphic, meteorological and hydrological Parameters: Rainfall intensity, runoff characteristics, sedimentation rate and discharge rate, soil, land use characteristics on runoff and infiltration.
3. Natural resources and human responses in watershed: soil, forest, water as natural resources and population interaction with them
4. Integration of watershed functions, processes and human interactions - Resource management: (Water conservation and water Harvesting – Soil conservation - Joint forestry management – land use management).
5. Watershed management: GIS Applications – case studies – Conservation - Models of Watershed: Soil erosion modelling, storm water and flood management - rainfall runoff process, subsurface flows and groundwater flow models.

### **References**

1. Elango, L. and R. Jayakumar (2001), “Modeling in Hydrology”, UNESCO, New Delhi.
2. Murty, JVS (1994), “Watershed Management in India”, Wiley Eastern Ltd,. New Delhi.
3. Rajesh Rajora (2002), “Integrated Watershed Management”, Rawat Publications, New Delhi

## **PRIC018 - 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.

## **PRIC019 - GEOINFORMATICS FOR CLIMATE CHANGE AND ADAPTATION**

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

## **PRIC020 - RESEARCH PROJECT WORK**

The project can be taken highlighting any issue relating to geographic knowledge and analysis. The project is for addressing problems relating to spatial data gathering, mining, warehousing and or raster / vector analysis and modelling. Programming or script writing can also be theme for the project, if it involves spatial data handling or analysis or modelling or in combinations of all. All data analysis and survey related projects shall necessarily present in a series of thematic maps.