

# UNIVERSITY OF MADRAS



## M.Tech Degree in GEOINFORMATICS

### *Syllabus*

### Semester Pattern (CBCS)

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

# UNIVERSITY OF MADRAS

## M.Tech. DEGREE IN GEOINFORMATICS

CBCS - Semester Pattern

### REGULATIONS

#### 1. Introduction

The M Tech programme has been designed to provide a unique educational opportunity in this subject area, and improve the understanding of the field of Geoinformatics, together with its implications and societal ramifications. The course is designed for advanced 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 geospatial technology for sustainable development planning. This course will be useful for government, and non-governmental agencies, planning consultancies, utility companies and resource developers and users.

#### 2. Objectives

The main objective is to provide a comprehensive advanced training in concepts, techniques, practicals and Project management in the field of Geoinformatics at the high level professions.

- To provide students with an in-depth knowledge of Geoinformatics technology and applications to work effectively with people from a wide range of disciplines and backgrounds
- To provide an intensive technical and applied aspect of Geospatial technology to students for career in industry, Government and Non Government, international and UN organisations, teaching and research.
- To build up a high level of practical skills and experience in the use of high quality hardware and software tools for automated mapping, analysis, spatial database design and management for development and management of resources..

#### 3. Target Groups and Careers

The M.Tech is mainly intended for those who are involved in the geospatial data inventory, mapping, planning and management in different sectors.

- Commercial sector, environmental agencies, local and national government, research, and academia
- 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, environmental consultancy, project officers, programmers and sales managers
- Emergency services, Public health and epidemiology, Planning and urban development, Crime mapping, Transportation and infrastructure
- And many more

Career opportunities will be highlighted through Field/site visits, guest lectures and chances to work with organisations as part of the M.Tech Dissertation. This course provides students with the technical and practical experience, specialist knowledge and problem-solving skills to pursue careers in any of these fields.

#### 4. Eligibility for Admission

A Candidate who has passed MA/MSc 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 M.Tech programme consists of minimum 91 credits and lasts for two years (Four semesters -full-time).

### **6. Medium of Instruction: English**

### **7. Project Work**

The M.Tech 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. 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.

### **8. 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.

Teaching is by a combination of illustrated lectures, practical demonstrations and student-led seminar discussions on pre-arranged topics. The programme includes core and optional papers, allowing students to gain necessary skills and knowledge in the subject, and also suit their individual aspirations and career plans. The internship and on job training course offers the opportunity to gain relevant experience and form links with organisations outside the University, an important feature given the nature of the subject of the degree.

### **9. Examination**

Examinations will be conducted at the end of each semester. Those candidates who have attended the intensive practical training only will be eligible to appear for theory examination.

The candidates who pass all the examination prescribed for the course in the first appearance only are eligible for ranking.

**M.Tech in GEOINFORMATICS**  
CBCS - Semester Pattern  
**Course for Study and Scheme of Examination**

Subject Code	Title of the Course	C/E/S	Credits			
			L	T	P	C
<b>I SEMESTER</b>						
EAS C501	Digital Cartography and GIS	C	2	1	1	4
EAS C502	Fundamentals of Modern Surveying	C	3	1	0	4
EAS C503	Practical –I: Field Survey and Geoinformatics	C	1	0	3	4
EAS C504	Practical –II – GIS Lab	C	1	0	3	4
Elective-1	Physical Survey and Field Techniques	E	2	1	0	3
Elective-2	Information System Management	E	2	1	0	3
UOM S001	Soft Skill *	S	2	0	0	2
<b>II SEMESTER</b>						
EAS C505	Geostatistics and Spatial data analysis	C	3	1	0	4
EAS C506	GIS and Geovisualisation	C	2	1	1	4
EAS C507	Photogrammetry & Remote Sensing	C	3	1	0	4
EAS C508	Practical-III: Photogrammetry and Image analysis lab	C	1	0	3	4
Elective-3	Field Survey and Resource Mapping (Field Work)	E	0	1	2	3
Elective-4	WebGIS and Location Based Web Service	E	1	1	1	3
UOM S002	Soft Skill *	S	2	0	0	2
<b>III SEMESTER</b>						
EAS C509	Applied Image Analysis and Modelling	C	2	1	1	4
EAS C510	Geoinformatics for Sustainable Housing and Settlements Planning	C	3	1	0	4
EAS C511	Applications of Geoinformatics for Natural Resource Management	C	3	1	0	4
EAS C512	Practical -IV- Spatial data Analysis and Management	C	1	0	3	4
Elective-5	Advanced Spatial Modelling and Programming	E	2	1	0	3
Elective-6	GIS Project Planning and Management	E	1	1	1	3
Elective-7	Mini Project	E	0	1	2	3
UOM S003	Soft Skill *	S	2	0	0	2
<b>IV SEMESTER</b>						
EAS C513	Project Work and Report	C	0	2	4	6
EAS C514	On job Training	C	0	1	3	4
EAS C515	Field work, Visualisation and spatial data analysis	C	0	1	3	4
UOM I 001	Internship	I	0	0	2	2
UOM S004	Soft Skill *	S	2	0	0	2

**Core - 62: Electives – 21: Soft skills – 08: Internship – 2 = 93 credits**

## FIRST SEMESTER

<b>EAS C501</b>	<b>Digital Cartography and GIS</b>	<b>C</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>4</b>
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1. Recent development of Cartography- automated mapping and geography- spatial thinking and analysis- mapping process- Cartography as language and communication - map characteristics and projections datums and geocoding- geographic data organization- accuracy, precision and reliability
2. Principles of cartography and graphic design- geographic representation-digital mapping and complex thematic mapping- qualitative and quantitative methods – layout- typography and lettering
3. Spatial data models and data structures- spatial database concepts-spatial analytical functionality- terrain modelling - spatial data quality, error and standards
4. Network analysis- Spatial interpolation and surface analysis- GIS and Spatial Modelling- spatial analysis approaches in socio-economic and environmental GIS applications
5. Cartographic visualization- dynamic and interactive cartography- Remote sensing, GIS and GPS for mapping resources - GIS is a data management tool, a mapping tool, a visualization tool and a spatial analysis engine.

### 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>EAS C502</b>	<b>Fundamentals of Modern Surveying</b>	<b>C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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1. Introduction to surveying: principles of surveying – measurement technology – traditional survey methods – automated survey systems.
2. 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, concepts of resolutions
3. 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
4. Sensors and sensing, optical mechanical and electronic sensor systems, microwave sensing, thermal scanning- Interpretation basics and methodology; *In-situ* support, collateral; Measurements and Instruments
5. GPS surveying- field work data collection- location information-distance measurement-resource mapping and analysis

### References

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

<b>EAS C503</b>	<b>Practical –I: Field Survey and Geoinformatics</b>	<b>C</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>4</b>
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Field survey shall be done using GPS instruments for collecting point, line and area based features  
 Topographic sheets and remotely sensed data shall be used to map various categories of geographic data. Data will be integrated with GIS data base in the laboratories.

<b>EAS C504</b>	<b>Practical –II – GIS Lab</b>	<b>C</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>4</b>
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1. Spatial data concepts, map and data models, map scale, Map projection and coordinate systems, Spatial data projection / coordinate transformation-Symbolize, classify, and label
2. spatial data-Map feature and raster data symbolization in ArcMap, GIS project and flowcharting. GIS database creation, GIS data creation and editing
3. Editor basics and feature creation, Editing existing features and attribute data, Spatial feature and table editing- Geocoding as a data input method, Geocoding addresses
4. Join attribute tables. Graphing and reporting-Attribute query and spatial query  
 Spatial operations for data preparation-Dissolving features, merging datasets, clipping layers
5. Spatial analysis: proximity and overlay-cartographic design and map presentation

**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. Chang, Kang-tsung, 2002, Introduction to Geographic Information Systems, McGraw-Hill Companies, Inc
4. Modeling Our World: The ESRI Guide to Geodatabase Design, by Michael Zeiler, ESRI Press, 1999
5. The ESRI Guide to GIS Analysis, by Andy Mitchell, ESRI Press, 1999, 188 pp.
6. Various handouts and supplements supplied by the instructors
7. Kang-tsung Chang (2002) Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing company Limited, New Delhi.
8. Chrisman, N. (1997) : Exploring Geographic Information systems, John Wiley & Sons., New York

**Web Resources**

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

<b>Elective-1</b>	<b>Physical Survey and Field Techniques</b>	<b>E</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>
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1. The nature and role of field research in geographic research- Topographic surveying-mapping in the field- Objectivity in field surveys- measurement and recording with GPS and other methods
2. Measurement and sampling issues; Field techniques and spatial sampling methods-cartographic techniques and spatial analysis - Equipment in geomorphic and soil surveys; GPS for site fixing, routing and contouring
3. Techniques in Physical geography- Hydrology and water quality data; Ground truth collection for remote sensing support
4. Concepts and principles of Participatory Research Appraisal (PRA) survey methods-Participatory GIS for community planning- Land system and land use surveys
5. Geoinformatics for spatial data management- interpretation and surface modelling; Data integration and GIS for resources assessment

**Reference s**

1. Garson, G.D. and R.S. Biggs (1992). Analytic Mapping and geographic databases, SAGE Publications, London.

2. Hanwell, J.D. & M.D.Newson (1973). Techniques in Physical Geography MacMillan, London.
3. Worthinton, B.D.R. and R,Gant (1975). Techniques in Map Analysis, Macmillan, London
4. Rabenhorst, T.D. and Paul D.McDermott (1989). Applied Cartography : Source Materials fro Map Making, Merrill Publishing Company, London.
5. Rabenhorst, T.D. and Paul D.McDermott (1989). Applied Cartography : Introduction to Remote Sensing, Merrill Publishing Company, London.
6. Mitchell, C.W. (1991). Terrain Evaluation, London Scientific and Technical Co., John Wiley & Sons, Inc. New York.

<b>Elective-2</b>	<b>Information System Management</b>	<b>E</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>
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1. scope and developments in information technology; Information technology firms-systematic framework for Information Systems; Components of information systems; Information systems design, analysis and management-Database Management Systems for Information Systems: Data resources, structure and functional aspects - data models
2. Information Systems – Strategic IS - information systems and ICT - mpact of ICT on the organisation and the world of work. - technological ICT - Organisational IS - use of ICT and the emerging Enterprise
3. IS management- Management information systems: needs, design and action; library resource information systems; human information systems- knowledge of information systems- Information Systems in Global Business Today-
4. Organizations, Management and the Networked Enterprise Information Systems in Global Business Today - world of the IS professional
5. Information and communications technologies - Information decision support system: Knowledge-based search process- Artificial intelligence technologies: Artificial intelligences and Expert Systems.

### References

1. Svenonius, Elane. The Intellectual Foundation of Information Organization. London : MIT Press, 2000
2. O'Brien, J.A. 1999: Management Information Systems, New York: Irwin-McGraw Hill.
3. Turban, E., R.K. Rainer Jr., and R.E. Potter 2000: Introduction to Information Technology, New Delhi: John Wiley.
4. Managing and Using Information Systems: A Strategic Approach: This book (4th edition; by Keri E. Pearlson and Carol S. Saunders; published by John Wiley and Sons: 2010
5. Laurini, R. 2001: Information Systems for Urban Planning: A Hypermedia Co-operative Approach, London and New York: Taylor and Francis.

### II SEMESTER

<b>EAS C505</b>	<b>Geostatistics and Spatial data analysis</b>	<b>C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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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

- 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

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

<b>EAS C506</b>	<b>GIS and Geovisualisation</b>	<b>C</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>4</b>
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- Technological Change and Visualization- - Web Mapping-Symbolisation - Color Use and Topography - Geovisualization – Visual Cognition
- Map Animation- Web GIS and Animated maps- Spatio-temporal animation- Map Representation- - Virtual Reality and 3D Cartography
- Visual Thinking and Visualization- Visualizing Uncertainty- maps and multimedia systems-animated maps and multi- dimensional display
- GeoVisualization with Google Earth and GIS- GeoBrowsers, and Geospatial Internet Search-**other** on-line mapping resources and mapping
- Visualisation support for multi-criteria decisions- From Geovisualisation toward Geovisual Analytics, - Geovisualisation, environment, security and Society

## References

- Terry Slocum et al,(2009)Thematic Cartography and Geovisualization Third Edition, by, Prentice Hall
- MacEachren, Alan M. (2004). How Maps Work: Representation, Visualization, and Design. New York: The Guilford Press.
- Slocum, Terry A., McMaster, Robert B., Kessler, Fritz C, and Howard, Hugh H. (2004). Thematic Cartography and Visualization. (Second Edition). Prentice Hall.
- Menno-Jan Kraak and Allan Brown (Ed.) (2001) Web Cartography. Taylor &Francis, London
- Menno-Jan Kraak and Ferjan Ormeling (1997) Cartography: Visualization of Cartography. Wesley Longman Limited, London
- Earnshan, R. John Vince and HUW Jones, (1997). Visualization and Modelling, Academic Press, UK
- 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.

## Web Resources

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



<b>EAS C507</b>	<b>Photogrammetry &amp; Remote Sensing</b>	<b>C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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1. Principles of aerial photo-aerial camera -Scale – overlaps – stereoscopy – concepts – viewing and measuring systems – image and object co-ordinates – floating mark – parallax equation – height information – Tilt- Flight planning – computation for flight plan – photo control – cost estimation – aerial mosaics
2. Concepts of interior, relative, absolute orientation – object, image relation – linearization – effect of orientation elements – scaling and leveling – analytical procedures – map compilation using stereo plotters -Elements of Aerotriangulation and analytical method – strip deformation, strip and block adjustment – Terrestrial photogrammetry – Orthophotography : Meaning, need, procedure, characteristics, uses and problems – Digital Photogrammetry
3. EMR and Remote Sensing: Energy sources - Electro Magnetic Radiation – Spectral regions - Energy Interaction in the atmosphere - atmospheric windows – Energy-interaction with earth surface features - spectral reflectance patterns for different region of EMR. Factors affecting remote sensing signatures. Platforms – data capture types and systems
4. Physical principles of remote sensing-Remote sensing systems.- Characteristics of digital images. Image pre-processing -spatial, geometric and scale transformations- atmospheric corrections and remote sensor calibration.
5. Image-domain filtering for feature extraction from remote sensing images-Methods image segmentation for environmental remote sensing-Approaches to extracting features from remote sensing images-Frequency-domain filtering of remotely sensed images.

#### References

1. Gottfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographic Information Systems, Second Edition, CRC; 2<sup>nd</sup> edition, 2009.
2. Paul R.Wolf, Elements of Photogrammetry, McGraw-Hill Science, 2001.
3. Karl Kraus, Photogrammetry, Vol 1&II , 4<sup>th</sup> edition, Dümmler, 1997.
4. Curran P.J (1985) Principles of Remote Sensing, Longman, Essex.
5. Lillisand T.M and R.W.Kiefer (1994) 3rd edition.Remote sensing and image interpretation, John Wiley & Sons, New York.
6. Sabins F.F Jr.(1987) Remote Sensing: Principles and Interpretation, W.H.Freeman & Co., New York

<b>EAS C508</b>	<b>Practical-III: Photogrammetry and Image analysis lab</b>	<b>C</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>4</b>
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1. Testing stereovision with test card -Finding stereoscopic acquity-Mirror stereoscope- base lining and orientation of aerial photographs- parallax bar
2. Orientations in Double projector -Orientations in Planicart- Orientation and mapping in semi analytical stereo plotter-demonstration of stereo metric camera, orthocomp, and analytical plotter.
3. Spectral reflectance observation of the following using handheld spectro radiometer-i) Vegetation, Soil and Water-Visual interpretation of different satellite data and aerial photographs for Land use/land cover and resource mapping.
4. enhancement and filters; Raster map: overlay analysis and multi-image manipulation; Supervised and unsupervised classification
5. Geostatistical mapping- spatial interpolation- index construction, correlation, regression and measurements- Spatio-temporal modeling

#### References

1. American Society of Photogrammetry, (1983). Manual of Remote Sensing, (2nd edition), ASP, Falls Church, Virginia
2. Lillisand.T.M, and Kiefer, P.W., (1998). Remote Sensing and Image Interpretation, John Wiley & Sons, New York.
3. Moffit, H.F., and Edward, M.M., (1980). Photogrammetry, Harperand Row Publishers, New York.
4. Wolf.P.R.,(1974).Elements of photogrammetry, McGraw Hill books Co., London
5. Dury, G.H. (1952). Map Interpretation. Sir Issac Pitman & Sons., Ltd., UK
6. Jensen, J.R. (1996). “Introductory Digital Image Processing, Prentice Hall. New Jersey.

<b>Elective-3</b>	<b>Field Survey and Resource Mapping (Field Work)</b>	<b>E</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
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The students will submit report based on fieldwork. This course work contains - Plan and schedule of the work carried out and comprehensive report on the fieldwork with cartographic techniques and field mapping. The students will go for a field work, which is compulsory and on the basis of that, each student has to submit a field work report as part of the course work containing (a) Plan and schedule of the work carried out (50 marks) and (b) Comprehensive report (50 marks).

<b>Elective-4</b>	<b>WebGIS and Location Based Web Service</b>	<b>E</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>
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Presently WebGIS and Location Based Service(LBS) have become a vibrant and rapidly evolving application area. Location-based services are often used via Web browsers and are in this case considered as a particular type of Web services. WebGIS can also be constructed via Web services. These represent a novel challenge for WebGIS and LBS.

1. GIS for Location-Based Services -Service based WebGIS and applications -Information Management in WebGIS
2. Application of WebGIS-Value-Added Services in WebGIS -Application based service computing-Principles and Methodologies of LBS
3. Data Management in LBS-Commercial Model of LBS-LBS Platforms and Tools-Web Service Based LBS and Its Applications-LBS and Social Network
4. LBS within 3G Wireless Communication Network-Novel Applications of LBS-LBS and WebGIS-WebGIS based mobile learning
5. Applications – location based marketing –emergency services-tracking-Case studies

#### References

1. <http://www.esri.com/industries/locationservices/business/literature.html>
2. <http://www.esri.com/industries/locationservices/business/case-studies.html>
3. [http://en.wikipedia.org/wiki/Location-based\\_service](http://en.wikipedia.org/wiki/Location-based_service)
4. [http://www.mobilein.com/location\\_based\\_services.htm](http://www.mobilein.com/location_based_services.htm)

### III SEMESTER

<b>EAS C509</b>	<b>Applied Image Analysis and Modelling</b>	<b>C</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>4</b>
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1. Image 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. Spatial Interpretation: remote sensing, field work and attribute data integration; Post classification task: -case studies.

#### 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>EAS C510</b>	<b>Geoinformatics for Sustainable Housing and Settlements Planning</b>	<b>C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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1. History of Human Settlement & Planning Principles: Relevance of evolution of human settlements in modern context. Historic determinants, settlement types: ancient, medieval, renaissance and industrial age
2. Origin and evolution of planning: Impacts of Industrial revolution on town planning and regional planning. Contemporary developments in planning in India - formation of metropolitan areas - socio-economic impacts of growth of population - rural-urban migration.
3. Contributions of Ebenezer Howard, Patrick Geddes, Tony Garnier, Lewis Mumford, Le-Corbusier and others in planning - The fundamental problems of the city - changes with time and growth - technological, social and other changes in size and scale - Physical nature and characteristics of the urban environment and its components
4. Models of planning processes - components of settlement structures - models of urban structure - demand and supply of land for urban use - means and mechanism - impact on urban structure - goals of land policy - Concept of land use, locational attributes of land use, land use planning - information system - activity system and choice of space qualities.
5. Goals of land policy - the interim and comprehensive plans - Structure Plan - Master Plan - Zonal Development Plan and Action plan their purpose and contents - System approach and physical planning- Land uses, physical structure and relationship between parts of city - Land use planning information system. for settlements- Case studies using geoinformatics applications

**References:**

1. Rown, O., A. Crawford, and A. Hammill. 2006. Natural Disasters and Resource Rights Building: Resilience, Rebuilding Lives. Winnipeg, Canada: International Institute for Sustainable Development (IISD). [http://www.iisd.org/pdf/2006/tas\\_natres\\_disasters.pdf](http://www.iisd.org/pdf/2006/tas_natres_disasters.pdf).
2. Centre on Housing Rights and Evictions. n.d. The Pinheiro Principles: United Nations Principles for Housing and Property Restitution for Refugees and Displaced Persons. Geneva: COHRE.
3. Food and Agriculture Organization (FAO). 1996. Guidelines for Land Use Planning. Rome: FAO. <http://www.fao.org/docrep/t0715e/t0715e00.HTM>.
4. IISD. 2006. Land use and land titled cases, experiences and policies, especially in Indonesia and SriLanka are explored in “Natural Disasters and Resource Rights: Building Resilience, Rebuilding Lives,”a report issued byIISD. [http://www.iisd.org/pdf/2006/tas\\_natres\\_disasters.pdf](http://www.iisd.org/pdf/2006/tas_natres_disasters.pdf).

<b>EAS C511</b>	<b>Applications of Geoinformatics for Natural Resource Management</b>	<b>C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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1. Concept of Resources: Concepts, classification and appraisal- Natural resources – natural resource economics - management of natural resources-Sustainability and resources management
2. Resource Assessment-I : Land evaluation methods- land classification methods-soil and water conservation- land use and Land cover mapping- land utilization- sustainable land use planning and sustainable development
3. Resource Assessment-II: sustainable 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. Natural resource surveys and monitoring– strategies for sustainable natural resource management- millennium eco-system assessment project-resources utilization and conservation in India.- case studies of Natural Resources Management with Geoinformatics applications

**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. Lillesand 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, co published 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.

<b>EAS C512</b>	<b>Practical -IV- Spatial data Analysis and Management</b>	<b>C</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>4</b>
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1. Interpolating environmental datasets- Exploratory data analysis: cluster analysis
2. Grid-based modelling-Terrain modelling- the basics and applications
3. Hydrological modelling - catchment models
4. Land suitability modelling- modelling- Location-allocation models -case studies
5. Spatial data management -Spatial interaction models-Spatial decision support systems

#### References

1. ESRI manuals
2. ERDAS manuals
3. Instructor manuals

<b>Elective-5</b>	<b>Advanced Spatial Modelling and Programming</b>	<b>E</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>
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1. Co-ordinate systems and geocoding, including methods of co-ordinate data storage, precision. General and complex data structures for both vector and raster data.
2. Concepts of databases, particularly issues of data accuracy, quality and management systems-Error modelling and data uncertainty, managing error including fractals and line generalisation Problems.
3. Visualisation of spatial data -Spatial interpolation for generating surfaces such as digital elevation models (DEMs) -Analysis and display of digital terrain models
4. Location modelling- suitability modelling-map algebra and spatial modelling - data driven and knowledge driven models, fuzzy logic for spatial analysis
5. GIS programming and customisation- of object-orientation and the difference between procedural and event-driven programming- GIS software and customisation

#### 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. 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.
5. 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.
6. ESRI Manuals and GIS software tutorials( available in the lab)

<b>Elective-6</b>	<b>GIS Project Planning and Management</b>	<b>E</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>
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This course consists of the following: Generic C&IT skills, project design and implementation, student centred learning, understanding people and organisations. This course involves a range of open learning strategies including course notes and materials, web-based resources, on-line discussion groups.

1. GIS project identification, design and management
2. Creating a conceptual and physical data model
3. Project design and management
4. Project management techniques and tools
5. Implementation issues (human and organisational) and problems
6. Project evaluation

## References

1. Ian Heywood, Sarah Cornelius and Steve Carver (2000), An Introduction to Geographical Information Systems, Addison Wesley Longman Limited, New York.
2. Chang, Kang-tsung, 2002, Introduction to Geographic Information Systems, McGraw-Hill Companies, Inc
3. Modeling Our World: The ESRI Guide to Geodatabase Design, by Michael Zeiler, ESRI Press, 1999
4. The ESRI Guide to GIS Analysis, by Andy Mitchell, ESRI Press, 1999, 188 pp.
5. Kang-tsung Chang (2002) Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing company Limited, New Delhi.

<b>Elective-7</b>	<b>Mini Project</b>	<b>E</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
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Mini project provides (a) application of skills and (b) practical / empirical experiences for the students, this course carries three credits as the case may be which includes oral presentation and submission short / long scientific article. This is done by way of fulfilling the 50-50 skills and hands-on exercises for the courses designed and have to be done in the Geospatial laboratories.

## IV SEMESTER

<b>EAS C513</b>	<b>Project Work and Report</b>	<b>C</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>6</b>
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The project is for addressing problems relating to spatial data gathering, mining, warehousing and or raster / vector analysis and modelling. All data analysis and survey related projects shall necessarily present in a series of thematic maps. With the thesis, the student demonstrates the ability to formulate and solve a scientific problem and to document the work in publishable form. The student has to develop research questions in geoinformatics, apply and develop methods to solve geoinformatics problems, Independent scientific and technical writing and Self motivated research, communication in teams and with advisors.

<b>EAS C514</b>	<b>On job Training</b>	<b>C</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>4</b>
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Depending on the goals of students, an external industry/research/NGO or government project will be chosen. During the semester, students have to stay in an industry or government or any other geoinformatics organisation and will collect work experience in professional projects. They document the work contents and results in a project report, where own contributions are clearly identified and assessed. The experiences will be exchanged with other students in a block course, where each student presents its experiences. The training will provide real time experience in the applications of geoinformatics, learning individual work, project work in teams, communicative qualities, network building and preparation for a professional career in the field.

The report has to follow academic and industrial standard of reporting complete with style manual adoption, digital formats and presentations standards

<b>EAS C515</b>	<b>Field work, Visualisation and spatial data analysis</b>	<b>C</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>4</b>
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The students will submit report based on fieldwork in the Fourth semester. This course work contains - Plan and schedule of the work carried out and comprehensive report on the fieldwork using GPS, remote sensing data etc. The students will go for a field work in the semester, which is compulsory and on the basis of that, each student has to submit a field work report as part of the course work containing (a) Plan and schedule of the work carried out (50 marks) and (b) Comprehensive report (50 marks).

<b>UOM I 001</b>	<b>Internship</b>	<b>I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>
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Each candidate has to spend at least 8 weeks in an institution / industry /educational Institution/ business house /IT industries, where GIS/ remote sensing/GPS or a combination of these above is the main activity which may also include marketing of such products. At the end of the internship the candidate has to produce an experience certificate and a report.