

M.Sc. Semester I to IV

Prospectus No. 20101238

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SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

PROSPECTUS
OF
MASTER OF SCIENCE EXAMINATION
Semester -I & III, Winter 2009
Semester -II & IV Summer 2010

IN
REMOTE SENSING & GIS



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**Syllabus for
M.Sc.Semester I & IV
Remote Sensing & GIS
Scheme of Examination**

**M.Sc.Part-I
Semester-I**

	Marks
Theory	
Paper I Basics of Computer and Information Technology	50
Paper II Principles of Aerial Remote Sensing	50
Paper III Satellite Remote Sensing	50
Paper IV Principles of Digital Image Processing	50
	Total 200
Practicals	
Practical I Measurements from Aerial and Satellite Images	50
Practical II Digital Image Processing	50
	Total 100
	Grand Total 300

**M.Sc.Part-I
Semester-II**

	Marks
Theory	
Paper V Principles of Geographic Information System	50
Paper VI Photogrammetry	50
Paper VII Thermal and Radar Remote Sensing	50
Paper VIII Remote Sensing Applications	50
	Total 200
Practicals	
Practical III Remote Sensing Applications	50
Practical IV GIS and Data Analysis	50
	Total 100
	Grand Total 300

**M.Sc.Part-II
Semester-III**

	Marks
Theory	
Paper IX GIS- Project Tasks	50
Paper X Spatial Modeling and Analysis	50
Paper XI Principles of GPS	50
Paper XII GPS GIS Integration and Applications	50
	Total 200

Practicals		
Practical V GIS Integration		50
Practical VI Field Survey and GPS Integration		50
		Total 100
		Grand Total 300

**M.Sc.Part-II
Semester-IV**

	Marks
Theory	
Paper XIII GIS Applications in Natural Resources and Management	50
Paper XIV GIS for Disaster Management	50
Paper XV Internet GIS	50
Paper XVI Thermal and Radar Remote sensing	50
	Total 200
Practical VII Remote sensing interpretations in water resources	50
Practical VIII Project Work	50
	Total 100
	Grand Total 300
Grand Total for M.Sc. Semester I, II, III and IV	1200

**Syllabus prescribed for
Remote Sensing & GIS
M.Sc.-I
SEMESTER-I**

Paper I

BASICS OF COMPUTER AND INFORMATION TECHNOLOGY

- Unit-I** Computers: Components – CPU – Input devices: key board, floppy, scanner, CD ROM. Output devices: monitor, printer and plotter.
- Unit-II** Operating System: DOS, Windows, Unix – Local Area Network – file management – function keys
- Unit-III** Information Technology: Communication – types – evolution – significance of communication in the modern world – global village and information revolution.
- Unit-IV** Internet and World Wide Web- browsing – advantages and limitations in information revolution – computer viruses and management.
- Unit-V** Multimedia: tools – paints and draw – applications – graphic effects and techniques – sound and music – multimedia atlas.

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- Dennis P. Curtin, Kim Foley, Kunal Sen & Cathleen Morin, Information Technology - The Breaking Wave, Tata McGraw Hill Ed., 1999.
- Rajaraman Y., Fundamentals of Computers, , Prentice Hall of India, New Delhi, 1999.
- Alex Leon, Fundamentals of Information Technology, Leon Techno Publications, Chennai, 1999.
- Subhash Metha, Understanding and Using Internet, Global Business Press, New Delhi, 996.

Paper II

PRINCIPLES OF AERIAL REMOTE SENSING

- Unit-I** History of Aerial Photography: Historical development of aerial remote sensing before 1900 and after 1900 - EMR, photographic bands, principles of photography and its applications in Earth sciences.
- Unit-II** Types of Photographs: Based on camera axis (vertical, oblique) angle of coverage (narrow, standard, wide angle, super-wide angle) lens (single, double, triple, four five and nine lens) and spectral characteristics (ultra-violet, orthochrome, panchromatic, black and white infra-red,

colour, colour infrared), Negative (glass plate, film), Reseau photograph, (plain and resseau) Multiband.

- Unit-III** Elements of Photograph: Marginal Information - scale of vertical photo: scale, determination of scale, scale distortion – relief displacement - tilted photographs - comparison of maps and aerial photographs – photo interpretation elements.
- Unit-IV** Aerial Cameras: Simple camera and lens formulae - parts of aerial camera: [a] lens cone assembly: filter, lens, shutter and diaphragm - camera coverage – [b] camera body: camera cone: spider, fiducial mark, advancing film, flattening the film, cocking and tripping the shutter, focal plane, [c] magazine: film advancing and flattening mechanism.
- Unit-V** Stereoscopic viewing: Anatomy of the human eye - Monoscopy, psuedoscopy and stereoscopy - depth perception - stereoscopic depth perception - stereo model.

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- American Society of Photogrammetry, (1983). Manual of Remote Sensing, (2nd edition), ASP, Falls Church, Virginia
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Paper III

SATELLITE REMOTE SENSING

- Unit-I.** Fundamentals: Definition - Scope - types and chronological development – ideal and real remote sensing system. Comparison of conventional survey, aerial remote sensing and satellite remote sensing - advantages and limitation of satellite remote sensing.
- Unit-II.** 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 - data recording method.
- Unit-III.** Remote Sensors: Electro-optical sensor systems - LANDSAT, SPOT, IRS and IKONS sensors - scanning and orbiting mechanisms - resolution: spatial, spectral,

radiometric and temporal resolution of the satellites. Multi concepts in remote sensing

Unit-IV. Other resources satellite programs of the world - need for geo-stationary satellite programs - sensor characteristics - meteorological, ocean monitoring and telecommunication satellites.

Unit-V. Satellite Data Product: Types – visual and digital – standard – special products – referencing system – annotation – image interpretation elements.

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2. Lillisand T.M and R.W.Kiefer (1994) 3rd edition. Remote sensing and image interpretation, John Wiley & Sons, New York.
3. Sabins F.F Jr.(1987) Remote Sensing: Principles and Interpretation, W.H.Freeman & Co., New York.

Paper IV

PRINCIPLES OF DIGITAL IMAGE PROCESSING

Unit-I Principles: Data encoding and decoding - digital image formats – band sequential and band interleaved - characteristic features. software - raster and vector files

Unit-II Image Rectification and Restoration: geometric correction, radiometric correction - noise removal - image enhancement: contrast manipulation - graylevel threshold, level slicing, and contrast stretching.

Unit-III Spatial Feature Manipulation: spatial filtering - convolution – edge enhancement - fourier analysis. multi image manipulation: spectral rating -principles and cannel components - vegetation components - intensity - hue - specturation color space transformation. Pattern Resolution: concepts - linear and non- linear discriminate function.

Unit-IV Supervised classification - classification stage - minimum distance to Means classifier - parallelepiped classifier - Gauss maximum likelihood classifier - training stage.

Unit-V Unsupervised classification-output stage post classification smoothing classification accuracy assessment.

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PRACTICAL I

MEASUREMENTS FROM AERIAL AND SATELLITE IMAGES

1. Stereoscopic vision test using Carl Zeiss Plate
- 1 Familiarization with pocket stereoscope
- 2 Familiarization with mirror stereoscope
- 3 Familiarization with prism stereoscope
- 4 Marginal Information of aerial photograph
- 5 Orientation of stereo model and marking principle point, fiducial axes and flight line.
- 6 Computing photo scale using known objects.
- 7 Computing photo scale using a map of known scale.
- 8 Computing photo scale using focal length and altitude.
- 9 Referencing system of various resource satellite images
- 10 Familiarization with Large Format Optical Enlarger
- 11 Visual Interpretation with Large format Optical Enlarger
13. Marginal information of various satellites images
14. Constructing spectral reflectance curves.

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PRACTICAL-II

DIGITAL IMAGE PROCESSING

1. Histogram construction for digital data.
2. Outputs of linear and non-linear sketch.
3. Filtered outputs.
4. Ratio images.
5. Change detection analysis.
6. Supervised classification.
7. Unsupervised classification.
8. Cell encoding by point, line and area features.
9. Run length encoding.
10. Leaf coding.

11. Map layers and raster layers.
12. Construction of DEM.
13. Encoding point, line and polygon features using vector data.
14. Label encoding.
15. Coding and referencing DEM, GRID and TIN.

*** Distribution of Marks for Practical-I & II :-**

Sr.No.	Practical No.	Practical	Marks
1	I	Measurement from aerial and satellite images (20+20) + Internal Assessment- Practical Record (3) + Viva-Voce (2) + Assignment (3) + Unit test (2)	50
2	II	Digital Image Processing (40) + Internal Assessment- Seminar (5) + Practical Record (3) + Viva-Voce (2)	50

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**M.Sc. Part-I
SEMESTER-II**

Paper V

PRINCIPLES OF GEOGRAPHICAL INFORMATION SYSTEM

- Unit-I** Introducing GIS and spatial data: Definition - maps and spatial information - computer assisted mapping and map analysis - components of GIS - people and GIS - maps and spatial data - thematic characteristics of spatial data - other sources of spatial data: census and survey data, air photos, satellite images, field data.
- Unit-II.** Spatial and attributes data modeling and Management: Spatial entities - Raster and Vector spatial data structures - comparison of Vector and Raster Methods – Raster and Vector approach to digital terrain modeling- modeling network – layered approach and object - oriented approach - modeling third and fourth dimension - problem of data

management - database management system - relational database model - linking spatial and attribute data - GIS database application and development.

Unit-III. Data Input and Editing: Integrated GIS database - Encoding methods of data input: keyboard, manual digitizing scanning and automatic digitizing methods, electronic data transfer - data editing: methods of developing and correcting errors in attributes and Spatial data: reproduction, transformation and Generalization – edge matching and rubber sheeting - integrated database.

Unit-IV. Data Analyzing Operation in GIS: Terminology's - Measurements of lengths, perimeter and area in GIS - queries - reclassification - buffering and neighborhood functions - integrated data - Raster and Vector overlay method: point-in-polygon, line-in-polygon and polygon- on-polygon - problems of Raster and Vector overlays - spatial interpolation - GIS for surface analysis - network analysis: shortest path problem, travelling problem, location - allocation of resources - route tracing.

Unit-V. GIS Modeling and Decision support system: Models of spatial processes: natural and scale analogue models - conceptual models - mathematical model - models of physical and environmental processes - modeling human process - problems related to using GIS to model spatial Processes. maps as output - alternative cartographic outputs - non-cartographic outputs - spatial multimedia - delivery mechanism - GIS and spatial decision supports - maps as decision tools.

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1. Haywood.L, Comelius.S and S. Carver (1988) A Introduction to Geographical Information Systems, Addison Wiley Longmont, New York.
2. Burgh P.A (1986) Principles of geographical Information System for Land Resources Assessment, Clarendon Press, Oxford.
3. Burrough PA 2000 PA McDonnell [2000] Principles of Geographical Information systems, London: Oxford University Press.

Paper VI

PHOTOGRAMMETRY

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

- Unit-II.** Photo Mosaic : Number of photos and film roll – exposure time and interval – drift angles - seasons and weather conditions – Mosaics – Ground Control point – Mosaic types and characteristics.
- Unit-III** Stereoscopic Plotting Procedures and Instruments : Direct optical projection plotters projection system, viewing system, measuring and tracing system -orientation of photography – stereo plotters with mechanical or optical – mechanical projection.
- Unit-IV** Instruments using the Zeus Parallelogram, instruments with optical –Mechanical pr ojections – Automated Stereo plotting Instruments : electronic image correlation and automatic stereo plotters, analytical plotters.
- Unit-V** Orthophotography : Meaning, need, procedure, characteristics, uses and problems – Digital Photogrammetry.

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- American Society of Photogrammetry, (1983). Manual of Remote Sensing, (2nd edition), ASP, Falls Church, Virginia.
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Paper VII

THERMAL AND RADAR REMOTE SENSING

- Unit-I** Thermal Remote Sensing: Radiant flux – heat transfer – thermal infrared radiation – thermal properties of materials – emissivity of materials – thermal inertia of Earth surface features.
- Unit-II** Thermal IR detection and imaging - characteristics of TIR images. Factors controlling IR Survey – applications - comparison of IR images with other TM band and air photographs.
- Unit-III** Radar Remote Sensing : Meaning – aircraft radar system – SLAR - components, imaging system, wavelengths – range and azimuth resolution - real aperture and synthetic aperture systems.
- Unit-IV** Satellite Radar system : Seasat SIR – radar return and image signatures – geometry of radar Images – geometry of radar images – mosaics.
- Unit-V** Image Characteristics: Polarization, look direction and image irregularity -image interpretation – terrain, structures, vegetation, sand, land use and land cover.

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- Alexey Bunkin and Konstantin Voliak, Laser Remote Sensing of the Ocean, John Wiley and Sons, 2001, Canada.
- Curran P.J. (1985) Principles of Remote Sensing, Longman, Essex.
- Gibso, P., and Clare H. Power, [2000] Introductory Remote Sensing Principles and concepts, Routledge, 1st edition, London.
- Hayes L., [1991] Introduction to Remote Sensing, Taylor and Francis Publication, London.
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Paper VIII**REMOTE SENSING APPLICATIONS**

- Unit-I** Remote Sensing Data: Types – digital, analogue – fluvial land forms – drainage pattern – erosional and depositional landforms – flood plain mapping - coastal landforms – erosional and depositional features – glacial landforms.
- Unit-II** Land Use/Land Cover: concepts – classification: USGS, NRSA - land use mapping – land evaluation. Agriculture : crop assessment, disease detection, forestry: types – species identification and disease detection.
- Unit-III** Soils : soil mapping - soil moisture – soil erosion – reservoir station – soil salinity – soil conservation.
- Unit-IV** Water Resources: surface water resources – water quality monitoring and mapping – water pollution, identification of ground water potential and recharge areas – integrated watershed development.
- Unit-V** Hazards: Analysis – earthquake and volcanoes – landslides – land subsidence – flooding – forest fire, desertification – coastal erosion – oil spill.

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www.terraweb.wr.usgs.gov/coastal.html

PRACTICAL-III**REMOTE SENSING APPLICATIONS**

Interpretation of aerial photography for :

1. Structural landforms
2. fluvial landforms
3. coastal landforms
4. Land use/Land cover mapping
5. Transport and settlement

Interpretation of Satellite Images for :

1. Structure and lineament
2. Fluvial landforms
3. Eolian landforms
4. Coastal landforms
5. Glacial landforms
6. Land use/ Land cover mapping
7. Urban land use
8. Soil mapping
9. Forest Cover
10. Digital data classification of land use

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PRACTICAL-IV GIS and Data Analysis

Surface Analysis

1. Contour
2. Slope
3. Aspect
4. Hill Shade
5. Shortest Path Analysis
6. Mapping Density and Spatial Modeling
7. Site Suitability Model
8. Dam Model
9. Creating TIN surface from Vector Data
10. Creating TIN from Raster Data

* Distribution of Marks for Practical-III & IV :-

Sr.No.	Practical No.	Practical	Marks
1	III	Remote Sensing Applications (40), Internal Assessment-Practical Record (3) + Viva-Voce (2) + Field Tour & submission of Report (5)	50

2	IV	GIS and Data Analysis(20+20) + Internal Assessment - Seminar (5) + Practical Record (3) + Viva-Voce (2)	50
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GIS - PROJECT TASKS

- Unit-I** Arc GIS: Introduction Arc Catalogue: viewing and connecting the data. Arc Map: working with maps –exploring map – adding a layer – adding features from data base – adding labels – working with map layout – saving and printing maps.
- Unit-II** Exploring GIS Data: Geographic data models – formats of feature data. planning a GIS project : GIS analysis – steps in a GIS Project – project planning. Assembling the data base: project data base – adding data to project folder – previewing data in Arc Catalogue organization – examining data in Arc Map – cleaning up catalogue tree.
- Unit-III** Preparing Data for Analysis: data preparation tasks – defining coordinate system for the elevation data – coordinate systems – projecting the river shape file – exporting the river shape file to the geodatabase = digitizing the historic park – merging parcel layers.
- Unit-IV** Performing Date Analysis: setting for analysis – plant site - delineating the area – within and outside the site – finding parcels to meet the criteria – finding vacant parcels –finding suitable parcels - finding suitable parcels meeting the required total area – reviewing analysis results.
- Unit-V** Presenting the Results: map design - setting up map page – creating overview map – creating maps of suitable and highly suitable parcels – creating parcel report – adding list of site criteria to map – adding map elements – saving and printing of maps.

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Paper X**SPATIAL MODELING AND ANALYSIS**

- Unit-I** Modeling Spatial Problems: Introduction - need for spatial models – conceptual model for solving spatial problems - steps involved. Types of spatial models – descriptive and process models – types of process models – creating conceptual models - site suitability model.
- Unit-II** Raster Modeling : Understanding raster data set - composition of raster dataset – coordinate space and raster data set – discrete and continuous data – resolution – raster encoding – representing features in raster data set – assigning attributes.
- Unit-III** Spatial Analysis : Understanding spatial analysis - operators and functions – local, focal, zonal, global and application functions – surface analysis: slope, hill shade, contour and hydrologic analysis – mapping distance: shortest path – mapping density – cell statistics – neighborhood statistics – reclassification.
- Unit-IV** Creating Surface models: Introduction – creating raster surface from points – interpolating a raster surface – creating TIN surface from vector data – building TIN – creating a TIN from a raster – creating a raster from a TIN.

Unit-V Analyzing Surfaces: Understanding the shape of a surface – calculating slope, mapping contours - deriving contour lines from a surface – calculating area and volume.

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www.earthmapping.com/papers

www.gis.esri.com/library/userconf/proc97/to250/pap209

www.innovativegis.com/basis/primer/organ.html

www.posc.org/Epicentre2_2/Datamodel/ExamplesofUsage/ey_cs.html

www.simpletechnologies.com/Projects_Executed.asp

www.students.sbc.edu/michael503

Paper XI

Principles of GPS

Unit-I. GPS and its utilities: Historical - Various GPS Software products and peripherals - recent trends.

Unit-II. System overview: The space segment – GPS satellite systems – new programmes - signal structure – control segment – tracing of satellites –control stations. user

segment – land navigation – vehicle location –surveying – marine navigator.

Unit-III Working principle of GPS: Simple navigation – satellite ranging; calculating the distance to the satellites - error sources; differentially corrected position – reference receiver - the rover receiver.

Unit-IV Geodetic Aspects: GPS coordinate system - local coordinate system –transformations - map projections and plane coordinates – the transverse Mercator Projection; the Lambert projection.

Unit-V. Surveying with GPS: GPS Measuring techniques – static surveys – rapid static surveys - kinematic surveys - RTK surveys; pre-survey

References:

1. ESRI Arc Pad Manual
2. Introduction to GPS (Global Positioning System) 1. by Leica.

Websites:

1. www.geography network.com
2. www.esri.com
3. www.gpsworld.com
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7. www.dbartlett.com
<http://quake.wr.usgs.gov>
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<http://terra.nasa.gov>
<http://www.pmel.noaa.gov>
<http://www.mojavedata.gov>
<http://www.regis.berkeley.edu/sue/phd>
<http://www.sfei.org>
<http://www.whrc.org/science/globfor>

Paper XII

GPS GIS Integration and Applications

Unit-I. Basic for GPS and GIS Integration: Windows CE devices and pocket PCs - transferring data to a window CE device - windows CE resources, maps and layers - layer properties: map projections:

- Unit-II** Displaying data: Creating a new map - adding layers - adding shape files - adding images - specifying a coordinate system – symbolizing data.
- Unit-III** Connecting and navigating with GPS: Supported GPS protocol; setting communication parameters - activating GPS - selecting a navigation destination - GPS track log - starting and stopping GPS track log - creating point, line and polygon features with GPS.
- Unit-IV** Editing the data and exporting to GIS environ: Editing basics – creating new layers for editing - selecting layers for editing – selecting feature for editing - moving and deleting features - extending a line; inserting and deleting vertices - moving a vertices - editing attributes. Preparing the data for Arc Pad - exporting symbology - creating an Arc Pad Map - packing shape files.
- Unit-V** GPS Applications: GPS Applications – Geo-referencing - sampling; cartographic updating - navigation and mobile tracking.

References:

ESRI ArcPad Manual Introduction to GPS (Global Positioning System) 1. by Leica.

Websites:

1. www.geography network.com
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**Practical V
GIS Integration**

- a. Working principles of GIS
- b. GIS integration techniques and applications
- c. Software and hardware needs of GIS
- d. Collecting ground control points
- e. Lines
- f. Polygons
- g. Editing points, lines and polygons
- h. Geo referencing using GIS techniques
- i. Exporting to GIS Environs.

**Practical VI
Field Survey and GPS Integration**

- a. Field survey
- b. Working principles of GPS
- c. Surveying with GPS
- d. Software and hardware needs of GPS
- e. Geo referencing using GPS
- f. GPS integration and applications

*** Distribution of Marks for Practical-V & VI :-**

Sr.No.	Practical No.	Practical	Marks
1	V	GIS Integration (40)+Internal Assessment - Practical Record (3) + Viva-Voce (2) + Assignment (3) + Unit test (2)	50
2	VI	Field Survey and GPS Integration (20+20)+ Internal Assessment - Seminar (5) + Practical Record (3) + Viva-Voce (2)	50

References:

ESRI ArcPad Manual Introduction to GPS - Global Positioning System by Leica.

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www.garmin.com
www.gps_society.org
www.dbartlett.com

**M.Sc.Part-II
SEMESTER VI
Paper XIII**

GIS Applications in Natural Resources and Management

- Unit-I** *Natural Resource Evaluation: Need – objectives – source of data – limitations –need for evaluation in development planning*
- Unit-II** Land Evaluation: Objectives – principles – procedures – approaches – land use requirements and land quality parameters – layer creation – matching – classification – case studies.

- Unit-III** Wastelands: Types – identification – management – eroded lands – types – layer creation – case studies.
- Unit-IV** Water Resources: Surface water: precipitation – space time analysis – overland flow – storage – groundwater: potential – quality – layer creation – overlay analysis – integrated watershed development – case studies.
- Unit-I** Natural Vegetation: Forests – classification (NRSA) – grasslands – layer creation – overlay – management – case studies.

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- Burrough, P.A. 1986. *Principles of Geographic Information Systems for Land Resources Assessment*. Walton Street, Oxford OX26DP, Oxford University Press.
- Fischer, M., H.J. Scholten, and D. Unwin, 1996. *Spatial Analytical Perspectives on GIS*, Taylor & Francis, London, UK.
- Fotheringham, S., and P. Rogerson, Ed. 1995. *Spatial Analysis and GIS*, Taylor & Francis, London, UK.
- Heit, Michael, H. Dennison Parker, and Art Shortreid (eds.), 1996. *GIS Applications in Natural Resources 2*, GIS World, Inc., Fort Collins, Colorado, 540p.
- Michael F. Goodchild, Louis T. Steyaert, Bradley O. Parks, 1996. *GIS and Environmental Modeling: Progress and Research Issues*. Fort Collins, CO80525: GIS World Inc. Available at the Evans Library reserve desk.
- Ripple, William J. (ed.). 1994. *The GIS Applications Book: Examples in Natural Resources: A Compendium*, American Society for Photogrammetry and Remote Sensing, Bethesda, Maryland.
- Young, Haines, David Green, and Steven Cousins (eds.), 1994. *Landscape Ecology and GIS*, Taylor & Francis, Bristol, P.A.
- Skidmore Andrew, 2002. *Environmental Modeling With GIS and Remote Sensing*, Taylor & Francis, London.

On-line journals:

- <http://camfer.CNR.Berkeley.EDU/monitoring/>- go to “Workgroup Resources”, and “Publications”.
- <http://www.gisdevelopment.net>

Links:

- ESPM 275 class Schedule
UC Berkeley Academic Calendar

CAMFER

Monitoring Landscape Change Workgroup

Paper XIV

GIS for Disaster Management

- Unit-I** Earthquake, Volcano and landslide: Meaning and types of disasters – earthquakes – volcanoes – landslides – selection of variables – creation of layers – space-time analysis – GIS for management plans – case studies.
- Unit-II** Cyclones and Flooding: Cyclone: cyclone related parameters and effects on land and sea – damage assessment. Flooding: topography, land use and flooding – space-time integration – GIS based parameters and layers – flood prone area analysis and management – risk assessment – case studies for cyclones and floods.
- Unit-III** Drought and Desertification: Types of droughts – factors influencing droughts – variable identification – vegetation index – land use /ground water level changes – delimiting drought prone areas – processes of desertification – over utilization of water and land resources layer creation – GIS based management strategies – case studies.
- Unit-IV** Anthropogenic Disasters: Atmospheric Disasters : Ozone layer depletion – green house / global warming – acid rain – snow melt – sea level rise – related problems layer creation – case studies. Marine Disasters: oil spill and chemical pollution – coastal erosion and deposition – variable identification – over lays – analysis / management strategies – case studies.
- Unit-V** GIS in Biodiversity Disasters: Ecological degradation – nuclear disaster and biodiversity loss – parameters (mapping of forest types, protected areas and natural forests) – population extinction – conserving bio-diversity (species and subspecies) – soil erosion – coral / mangrove depletion – forest fire-mining – overlay analysis – GIS in environmental modeling – case studies.

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1. Korte, G. B., (2001) the GIS book: 5th edition, Onward Press, Australia.
2. Anji Reddy, M., (2001) Remote Sensing and Geographical Information Systems., 2nd edition, Bs.Publications, Hyderabad.
3. Demers, Michael N., (2000) Fundamentals of Geographic Information Systems, John Willey and sons. Inc. New York.

4. John A. Matthews (2002) Natural hazards and environmental change, Bill McGuire, Ian Mason.
5. Andrew Skeil (2002) Environmental Modeling with GIS and Remote sensing, John Willey and Sons, Inc New York.
6. John. G. Lyon (2003) GIS for Water Resource and water Shed Management, Taylor and Francis.

Paper XV
Internet GIS

- Unit-I.** Introduction: Internet, web and Internet GIS. Fundamentals of computer networking – network environment – network communication models – Protocols – TCP/IP.
- Unit-II** Client/server computing – client – server – glue – client/server system partition – layered architecture – advantages and disadvantages of client server architecture. Distributed component framework – web mapping – static and interactive web mapping – open GIS web map server.
- Unit-III** Distributed geographic information services – principle – components – logic and data components.
- Unit-IV.** Geographic markup language - principle – characteristics - commercial web mapping programs - mobile GIS. Distributed GIS in data warehousing and data sharing.
- Unit-V** Internet GIS Applications in intelligent transportation systems, planning and resource management.

Paper XVI

Thermal and Radar Remote Sensing

- Unit-I** Thermal Remote Sensing: Radiant flux – heat transfer – thermal infrared radiation – thermal properties of materials – emissivity of materials – thermal inertia of Earth surface features.
- Unit-II** Thermal IR detection and imaging - characteristics of TIR images. Factors controlling IR Survey – applications - comparison of IR images with other TM band and air photographs.
- Unit-III** Radar Remote Sensing : Meaning – aircraft radar system – SLAR - components, imaging system, wavelengths – range and azimuth resolution - real aperture and synthetic aperture systems.
- Unit-IV** Satellite Radar system : Seasat SIR – radar return and image signatures – geometry of radar Images – geometry of radar images – mosaics.

- Unit-V** Image Characteristics: Polarization, look direction and image irregularity -image interpretation – terrain, structures, vegetation, sand, land use and land cover.

Practical VII

Remote sensing interpretations in water resources

01. Spectro Radiometric Survey of Water Bodies.
02. Analysis of Aerial Photographs and Satellite Images for Drainage Morphometry and Water Shed Demarcation.
03. Analysis of Satellite and Aerial Photographs for Surface Water Resources Mapping.
04. Water Quality and Snow Cover Mapping Using Satellite Data.
05. Analysis of Satellite and Aerial Photographs for Mapping Lithologically And Structurally Controlled Aquifer Systems.
06. Mapping of Geomorphic Aquifers
07. Identification Of Recharge Areas Using Remotely Sensed Data.
08. Analysis of Thermal and Microwave Data for Ground Water Targeting.
09. Land use / Land cover Mapping Upto Level II Using Aerial Photos and Satellite Images.

Practical VIII

Project work

Each student should undertake Project work allotted by the Head of the Department in a given area pertaining to Remote Sensing and GIS by the end of Semester V and should submit project report by the end of Semester VI.

*** Distribution of Marks for Practical-VII & VIII :-**

Sr.No.	Practical No.	Practical	Marks
1	VII	Remote Sensing, interpretation in water resources (40) + Internal Assessment - Practical Record (3) + Viva-Voce (2) + Field Tour & submission of Report (5)	50
2	VIII	Project Work (20)+Submission of Report (10) + Presentation (10) + Internal Assessment - Seminar (5) + Viva-Voce (5)	50

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- Korte, G. B., (2001) The GIS book: 5th Edition, Onward press, Australia.
- Cartwright, W., M.P. Peterson, G. Gartner (Eds) Multimedia Cartography, Berlin: Springer.

Kraak, M., and A. Brown (2001) Web Cartography: Development and Prospects, London: Taylor and Francies.

Kraak, M. and F. Ormeling (2003) Cartography: Visualization of Geospatial Data, Delhi: Pearson Education.

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INDEX

**M.Sc.Part-I & Part-II (Semester I to IV) Examinations in
Remote Sensing & GIS
(Prospectus No. 20101238)**

Sr. No.	Paper/ Practical No.	Title of Paper/ Practical	Page Nos.
1.	Special Note		1
2.	Ordinance No. 4 of 2008		3
M.Sc.Part-I Semester-I			
Theory			
3.	I	Basics of Computer and Information Technology	3
4.	II	Principles of Aerial Remote Sensing	3
5.	III	Satellite Remote Sensing	4
6.	IV	Principles of Digital Image Processing	5
Practicals			
7.	I	Measurements from Aerial and satellite Images	6
8.	II	Digital Image Processing	6
M.Sc.Part-I Semester-II			
Theory			
9.	V	Principles of Geographic Information System	7
10.	VI	Photogrammetry	8
11.	VII	Thermal and Radar Remote Sensing	10
12.	VIII	Remote Sensing Applications	11
Practicals			
13.	III	Remote Sensing Applications	12
14.	IV	GIS and Data Analysis	13
M.Sc.Part-II Semester-III			
Theory			
15.	IX	GIS- Project Tasks	15
16.	X	Spatial Modeling and Analysis	16
17.	XI	Principles of GPS	17
18.	XII	GPS GIS Integration and Applications	18

Practicals			
19.	V	GIS Integration	19
20.	VI	Field Survey and GPS Integration	19

M.Sc.Part-II Semester-IV			
Theory			
21.	XIII	GIS Applications in Natural Resources and Management	20
22.	XIV	GIS for Disaster Management	22
23.	XV	Internet GIS	23
24.	XVI	Thermal and Radar Remote sensing	
Practicals			
25.	VII	Remote sensing interpretations in water resources	24
26.	VIII	Project Work	24