A N D H R A U N I V E R S I T Y

Regulations and Syllabus relating to
Master of Technology (M.Tech.) Degree Courses

In
REMOTE SENSING
(w.e.f. 2015-2016 admitted batch)

M.Tech. Remote Sensing course

An applicant for admission into the M.Tech. Remote Sensing should have at least a second class with not less than 55% marks degree in either:

B.E. / B.Tech. in any Engineering

OR

Master's degree in science

In the available number of seats, 50% are reserved for B.E./B.Tech. Applicants. If sufficient number of eligible applicants is not available in either of the two groups, the eligible applicants from the other group are given admission, to fill all the available seats in M.Tech. (Remote Sensing).

1. A) A regular course of study means attendance is not less than 75 per cent of lectures, practical, drawing exercises, workshop and practical and field and project work, if any, in such semester in such subject, according to the scheme of Instruction to be notified by the Head of the Institution, provided that in special cases for sufficient cause again the Vice-Chancellor may on the recommendation of the Principal, condone the deficiency in attendance, not exceeding 10 per cent, for reasons of ill-health when the application is submitted at the time of the actual illness and is supported by an authorized Medical Officer approved by the Principal.

   B) However, in the case of students, who participate in activities, such as NCC, Inter-University Tournaments, National Tournaments, Inter University Courses. NSS and any such other activities deemed genuine by the Head of the Department Concerned, the period of their absence for the above purpose can be condoned by the Principal on the recommendation of the Head of the Department.

2. A) There shall be a written examination at the end of each of the first two semester in the subjects offered in the respective semesters.

   B)The Candidate should choose one elective from Elective-1 and Elective-2 in the first and second semester.

   C) The candidates are required to submit, at the end of the fourth semester, three copies (as prescribed) of the dissertation on or before a date to be notified by the University from time to time, accompanied by three copies of a short summary, all of which will be retained by the University.

   D) At the end of the third semester and fourth semester, an evaluation of the dissertation there shall be viva-voce (preliminary) for 100 marks (1) and (2) a viva voce for 100 marks on the dissertation and related subjects.

   E) Marks for sessional work shall be allotted by the Teaching Staff of the college on the basis of class work, slip tests, practical works, etc., and the list of marks shall be sent to the Registrar, before the commencement of the written examination.

   F) For taking the examination in the theory in any subject candidates shall be required to obtain a minimum of 50 per cent in sessional work in that the subject, failing which, they shall be required to repeat the course in that subject in the semester in which it is offered again for study.

   G) Candidates who fail to secure the minimum prescribed marks in that subject will be permitted to continue the studies in the next semester. They shall, however, be required to pass the examination in the subjects in which they have failed, in the subsequent examination.

   H) Candidates who have secured not less than 40 per cent in any of the theory papers and not less than 50 per cent of the total maximum marks of the theory paper and sessionals put together shall be declared to have passed the examination in that subject. In the case of subjects in which no written examination is prescribed, candidates should secure 50 per cent of the marks allotted to each of these subjects.

3. A) The evaluation of Project work / Research work will be done by conducting viva voce examination at the end of third and fourth semester by a Board of Examiners consisting of:

   1. Head of the Department
   2. Chairman, Board of Studies
   3. The Internal Research Director
   4. One or two experts from outside the Department / University nominated by the Vice-Chancellor.

The dissertation shall be either "recommended"(with grades A, B, C), or "Not recommended"(with grade F stands for failed).

4. Candidates who have passed all the subjects of the course and secured not less than 60 per cent of the aggregate of marks, shall be declared to have passed in first class. All the remaining successful candidates shall be declared to have passed in second class.

5. Candidates who fail in the subjects of any semester will be deemed to have been conditionally promoted. They shall however, have to appear and pass only in the subjects in which they have failed. Candidates have to take the examination in the subjects in which they have failed during these semesters, when the University conducts the examinations in those subjects.

6. The marks obtained will be converted to grades on a 10 point scale and then to Semester Grade point Average(SGPA) and subsequently Cumulative Grade Point Average is awarded at the end of the course by University.

Department of Geo-Engineering
M.Tech.Remote sensing
Scheme of Instructions and examination
(with effect from 2015-2016 academic year)
I-SEMESTER

Code No.	Course Title	Scheme of Instructions			Scheme of Examinations			Total	Credits
		Lec.	Tut.	Total	Duration of Exam. (hrs)	Theory/ Lab/ Viva	Sessional		
RS 1.1	Mathematics and Statistics	4	-	4	3	70	30	100	4
RS 1.2	Principles of Remote Sensing	4	-	4	3	70	30	100	4
RS 1.3	Principles of Photogrametry and Photo interpretation	4	-	4	3	70	30	100	4
RS 1.4	Earth Systems	4	-	4	3	70	30	100	4
RS 1.5	**Elective 1** **A**. Coastal Zone Management **B**. Natural Disaster Management **C**. Satellite Meteorology, Agriculture and Oceanography	4	-	4	3	70	30	100	4
RS 1.6	**Elective 2** **A**. Mathematical Morphology in Image Processing **B.**Water Resources Management C. Geoinformatics for Earth Science Applications	4	-	4	3	70	30	100	4
RS 1.7	Lab:1 Photogrammetry and Photo Interpretation Practical	-	3	3	Viva-Voce	50	50	100	2
Rs 1.8	Lab:2 Remote sensing and image interpretation Practical	-	3	3	Viva-Voce	50	50	100	2
		24	6	30		520	280	800	28

Department of Geo-Engineering
M.Tech.Remote sensing
Scheme of Instructions and examination
II-SEMESTER

Code No.	Course Title	Scheme of Instructions			Scheme of Examinations			Total	Credits
		Lec.	Tut.	Total	Duration of Exam. (hrs)	Theory/ Lab/Viva	Sessional		
RS 2.1	Digital Image Processing and Interpretation	4	-	4	3	70	30	100	4
RS 2.2	Remote Sensing applications	4	-	4	3	70	30	100	4
RS 2.3	Geographic Information Systems	4	-	4	3	70	30	100	4
RS 2.4	Advances in Remote Sensing	4	-	4	3	70	30	100	4
RS 2.5	**Elective 1** **A.**Geoinformatics for Environmental Monitorring **B**. Watershed Management and Analysis **C**.Urban planning and information systems	4	-	4	3	70	30	100	4
RS 2.6	**Elective 2** **A**.DigitalPhotogrametry and Mapping **B.** Geoinformatics for Resources Development and Disaster Management **C**.Sapatial Data Base Handlilling, Modelling, and GIS Implementing Architecture	4	-	4	3	70	30	100	4
RS 2.7	Lab:.1 Digital Image Processing practical	-	3	3	Viva-Voce	50	50	100	2
Rs 2.8	Lab:.2 GIS practical	-	3	3	Viva-Voce	50	50	100	2
		24	6	30		520	280	800	28

III- SEMESTER

Code No.	Course Title	Scheme of Examination	Total Marks	Credits
RS 3.1	Dissertation(Preliminary)	Viva - Voce	100	12

IV-SEMESTER

Code No.	Course Title	Scheme of Examination	Total Marks	Credits
RS 4.1	Dissertation(Final)	Viva - Voce	100	12

I-SEMESTER
RS 1.1 Mathematics and Statistics

Unit-1

Fundamentals: Sets and Subsets, Sequences, Operations on Sets; Counting sequences, and subsets (permutations and combinations) Algorithms and Psudocode: Induction and Recursion: Division in the integers: Matrices

Unit-2

Relations and Digraphs; Product sets & Paths in Relations & Digraphs; Properties of Relations; Equivalence Relations; Computer Representation and Digraphs; Manipulation of Relations; Transitive closure and Warshall's Algorithm.

Unit-3

a) Functions;
Functions - The Pigeonhole principle; Permutations

b) Trees & Languages
Trees; Labeled Trees; Language; Context free languages and derivation trees. Ambiguity in context free grammar.

Unit-4

1) Measurement of Central Tendency, Mean, Mode, Median, Geometric mean and Harmonic Mean.
2) Measures of variations - Range, Quintile deviations, Mean deviation, Standard deviation and variance, Coefficient of variations.
3) Probability concepts - Additions and multiplication laws, Basic problems on these laws. Concept of random variables and probability distribution.

Unit-5

1) Theoretical distribution; Binomial, Poisson and normal with application.
2) Correlation Analysis - Introduction, Karl Pearson's Coefficient of Correlation, Auto Correlation.
3) Regression Analysis - Linear regression analysis; Curve fitting concept of multiple regression analysis.
4) Theory of Sampling - Meaning of a sample, Universe, static and parameters. Sampling distribution, standard error. Different sampling techniques like scruple random sample, standard random sample, systematic, cluster and multi-storage sample.

Text Books

1) Statistics by S.P. Gupta
2) Statistical theory and methods by SANCHETIC and Kapoor
3) Statistics by S.C.Gupta

RS 1.2 Principles of Remote Sensing

Unit-I Basics of Remote Sensing

a) **Overview of Remote sensing:** Definition of Remote sensing
Principles of Remote Sensing, Electromagnetic Radiation, Radiometric terms and definitions, Radiation Laws, EM spectrum, Sources of EM, Interaction of EM Radiation with atmosphere, and target, Atmospheric Widows, imaging spectrometry, Spectral signature of various land cove features

b) PLATFORMS AND SENSORS

- **Platforms:** Types of platforms, ground, airborne, and space born platforms, Orbit of satellites, Kepler's Law, satellite characteristics, satellites for Earth observations studies, and planetary missions (Chandrayana)
- **Sensors:** Types and classification of sensors, imaging modes, Characteristics of optical sensors, sensor resolution-spectral, radiometric and temporal, Characteristics of detectors,

Unit-II a) Data reception, Data processing & Data generation

- Ground station, Data generation, Data processing & correction

b) Radiometric and Geometric corrections

- Radiometric corrections Random noise correction
- Atmospheric correction, Geometric errors and corrections,
- Distortion evaluated from tracking data, distortion evaluated from ground control Image correction.

c) Ground Investigation in support of Remote sensing

- Uses of ground data, calibration correction, Interpretation of properties, Training sets, Accuracy evaluation, test sites
- Ground truth Instruments and spectral signature,
- Spectral Reflectance and spectral signature of vegetation
- Sources of RS data: Global and Indian data products

Unit-III : Visual Image Interpretation

- Introduction to Visual Interpretation, Basic principles of Visual Interpretation
- Elements of Visual Interpretation, Techniques of Visual Interpretation
- Interpretation Keys, Methods of searching and sequence of Interpretation
- Methods of analysis and Reference levels
- Computer compatible tapes – Band sequential format, Band interleaved by Line format, Run-length encoding format.
- Hardcopy outputs – Generation of B/W and False Color Composites. Generally supported scales of the data products, Information about annotation of the products.

Unit-IV: Thermal Imaging system

- Thermal Imaging System: Introduction - IR region of the Electromagnetic spectrum, Atmospheric transmission, Kinetic and radiant temperature, Thermal properties of materials, Emissivity, Radiant temperature. Thermal conductivity. Thermal capacity, thermal inertia, apparent thermal inertia, Thermal diffusivity.
- Radiation principles (Plank's Law, Stephen Boltzman law), Interaction of EMR with earth surface, Wien's displacement law, Kirchoffs Law).
- IR - radiometers, Airborne and Satellite TTR scanner system
- Characteristics of IR images
  i) Scanner distortion, ii) image irregularities, iii) Film density and recorded iv)Temperature ranges
- Effects of weather on images
  i) Clouds, ii) Surface winds, iii) Penetration of smoke plumes
- Interpretation of thermal imagery
- Advantages of Thermal imagery

Unit-V Microwave Remote Sensing

- Introduction - Electromagnetic spectrum, Airborne and Space borne radar systems basis instrumentation.
- System parameters - Wave length, Polarization, Resolutions, Radar geometry.
- Target parameters - Back scattering, Point target, Volume scattering, Penetration, Reflection, Bragg resonance, Cross swath variation. Speckle radiometric calibration.
- Microwave sensors and Image characteristics, Microwave image interpretation
- Application : Geology, Forestry, Land use, Soils etc. Future trends and Research
- Physics of lager, laser interaction with objects. Types of LiDAR (Topographic, Bathymetric) platforms of LiDAR, components of LiDAR.

List of Text Books

1. Floyd, F. Sabins, Jr: Remote Sensing Principles and Interpretation, Freeman and Co., San Franscisco, 1978.
2. Illesand and Kiefere: Remote Sensing and Image interpretation, John qwiley, 1987.
3. Manual of Remote Sensing Vol. I&II, 2nd Edition, American Society of Photogrammetry.
4. Remote Sensing: The quantitative approach, P.H. Swain and S.M. Davis, McGraw Hill.
5. Introductory Digital Image Processing: A remote sensing perspective, John R. Jensen, Prentice Hall.
6. Imaging Radar for Resource Survey: Remote Sensing Applications, 3, W Travelt, Chapman & Hall.
7. Remote sensing Notes –Edited by Japan Associates of Remote sensing- JARS 1999

RS 1.3 Principles of Photogrammetry and Photo interpretation

UNIT- I

Fundamentals of Photogrammetry and Photo interpretation – types of photographs; Vertical photographs – principal point; scale; Stereoscopy; Vertical exaggeration – factors involved and determination; Overlap, sidelap and flight planning

UNIT- II

Geometric elements of vertical aerial photographs; Relief Displacement on vertical aerial photographs; Parallax and parallax measurement – monoscopic and stereoscopic methods; Determination of horizontal ground length, direction and angles from photo coordinates;

UNIT - III

Aerial mosaics: comparison with maps; Elements of aerial photo interpretation – (a) landforms; (b) surface drainage patterns; (c) erosion features, (d) gray tones; (e) miscellaneous elements.

UNIT - IV

Digital Photogrammetry: definition and scope; Photographs and images; Geo-referencing – Interior orientation, exterior orientation; aerotriangulation – single frame and block triangulation - pass points, tie points; ground control points; Satellite photogrammetry

UNIT - V

3-D surface modeling – DEMs, DSMs and DTMs; Triangulated irregular networks; Gridded surfaces; interpolation methods; Contour representation; Terrain visualization; DEM user applications.

Textbooks

1. Aerial photographic interpretation, Lueder, D.R., McGraw Hill Book Co., 1959
2. Elements of Photogrammetry, Paul R. Wolf, McGraw-Hill, 2000
3. Remote sensing and Image interpretation, Lillesand and Keifer, John Wiley and Sons, 2000
4. Manual of Photogrammetry, McGlone, C., Edward, M. and Bethel, J, American Society for Photogrammetry and Remote Sensing, Bethesda, MaryLand, USA. 2005
5. Digital Elevation Model Technologies and Applications: The DEM user Manual, David F. Maune (ed), American Society for Photogrammetry and Remote Sensing, Bethesda, MaryLand, USA, 2001
6. Leica Photogrammetry Suite – Orthobase and Orthobase Pro User Guide, Leica Geosystems, GIS & Mapping, Atlanta, USA, 2003.

RS 1.4 Earth Systems

Unit-1

a) Earth - Orbit, Rotation, Time
b) Oceans - Depth, Bottom relief
c) Oceans - Temperature, Salinity, Density of seawater
d) Oceans - Waves, Tides, Currents
e) Climate and the atmosphere – Origin, nature, composition and vertical division of the atmosphere.

Unit-2

a) Meteorological parameters and their measurements - Geographical, seasonal and vertical distribution of temperature, pressure, wind and precipitation.
b) Solar and terrestrial radiation: Distribution in clear, cloudy and average conditions. Mean heat balance.
c) Weather disturbances: Air mass and Front, Cyclone and anti-cyclone. Thunderstorm and tornado.
d) Weather analysis and Forecasting
e) Climate and agricultural factors in crop production.

Unit-3

a) Climate Change: Causes and Impacts
b) Monsoons : Concepts of the origin of monsoon - Indian Monsoons
c) Fundamental concepts of Geomorphology
d) Weathering, Mass wasting and erosion.

Unit-4

a) Wind and associated land forms
b) Seas and associated land forms
c) Land forms associated with faults and folds
d) Rivers and associated land forms
e) Glaciers associated land forms

Unit-5

a) Soil forming processes, Soil profile, Soil components.
b) Pedogenic regimes.
c) Classification of soils
d) Soils of India

List of Text Books

1. Structural Geology by Billings, M. 1984
2. Earth History & Plate Tectonics by Carl K. Seyfert, Leslie A. Sirkin
3. Geology of India & Burma by M.S. Krishna 6th, Ed.
4. General Climatology by H.J. Critchfield
5. Physical Geology by Arthur Holmes
6. Physical Geography by Stahler
7. The Atmosphere by Frederick K. Lutgens and Edward J. Tarbuck

Syllabus for Elective Subjects

RS. 1.5. Elective 1.

A. Coastal Zone Management
B. Natural Disaster Management
C. Satellite Meteorology Agriculture and Oceanography

A. Coastal Zone Management

Unit 1

Coastal and littoral zones – definitions and scope of study

Shore zone processes – waves, tides and currents
Coastal landforms;
River deltas: types of deltas and their morphological variations
Human activities and their impact on the delta-fringe coasts

Unit 2

Coastal wetlands – Mangrove swamps, marshes, lagoons, tidal channels/creeks and their significance in coastal stability and economic importance
Continental margins – forms and processes; territorial waters and Exclusive Economic Zone
Sea level changes – factors involved; effects of sea level oscillations on coastal zones
Sea-level rise and coastal vulnerability; Role of geoinformatics in assessment of coastal vulnerability to sea-level rise

Unit 3

Coastal Hazards:
Storm surges and Tsunamis
Origin, propagation and run-up of tsunamis;
Tsunami impact – role of coastal topography and vegetation;

Global warming and Sea-level rise - impact on coastal zones; coastal vulnerability assessment
Coastal hazard preparedness – coastal protection, education and awareness of coastal communities; Role of geoinformatics in assessment of coastal vulnerability to tsunamis

Unit 4
Human activity and coastal environment – deforestation, griculture/aquaculture,pollution and coastal structures, and their effect on coastal zones
Coastal vegetation; shelter belts; coastal aquifers; freshwater-seawater interface
Morphology of Indian coasts

Unit 5
Coastal zone management – concepts, models and information systems
Coastal Regulations Zones (CRZ) and Coastal Management Zones (CMZ):Indian context
Application of remote sensing in coastal zone studies
Role of Geographic Information Systems in coastal zone studies

Text books

1. Geomorphology, Bloom, A.L., Prentice-Hall, 1978
2. Deltas, Coleman, J.M., Continuing education Publication Co.Inc. 1976
3. Coastal Sedimentary Environments, Davis, A.R. (Jr.), Springer-Verlag, 1985.
4. Beaches and Coasts, King, C.A.M., Edward Arnold, 1972
5. Introduction to Marine Geology and Geomorphology, King, C.A.M., Edward Arnold, 1974
6. Applications in Coastal Zone Research Management, Martin, K.St. (ed), U.N. Institute for Training and Research, 1993.
7. ntegrated Ocean and Coastal Management, Sain, B.C., and Knecht, R.W.,UNESCO Publication, 1998.
8. Subtle Issues in Coastal Management, Sudarshan et al., (ed), IIRS, Dehra Dun, 2000.
9. Tsunamis – case studies and recent developments, Satake, K. (ed), Springer, 2005

RS. 1.5.Elective 1.

B.**Natural Disaster Management**

Unit-1

Various types of Natural Disasters - Cyclones, Floods and Tidal waves with most well known Indian examples, Classification of Disasters and nature of Impacts.

Unit-2

Various types of Natural Disasters - Earth quakes, land subsidence and Land slides, Forest fires, Drought with most well known Indian examples, Classifications and nature of impacts.

Unit-3

Vulnerability factors and Risk analysis of Natural disasters and Hazard estimations.

Unit-4

Natural disaster management plans, Shelterbelts, Special structures, Disaster preparedness and Mitigation.

Unit-5

Information needs of Disaster management, Remote Sensing Applications, GIS applications.

References

1. Krishna Prem & Bhanfari, N.M. (1967): Risk assessment due to strong Wing storms / Cyclones and preventive measures for Habitat Buildings; Proceedings volume 1 of International Conference on Habitat and sustainable Development, Decembe4 1-2-1997 organized by Institute of Engineers (India) and World Federation of Engineering Organisations.
2. Vijay, P.B. Kurian, Jose and Mittal, A.K. (1997): An overview on the Earthquake mitigation sceanrio in India: Proceeding volume-1 of International Conference on habitat and Sustainable Development, December 1-2-1997 organized by Institute of Engineers (India) and World Federation of Engineering Organisations.
3. Mandal, G.S. (1995): Tropical cyclones and their damage potential, status of Wind Engineering in India, Indian Society of Wind Energy (ISWE).
4. Government of India (1997): Ministry of Urban Affairs and Employment: Vulnerability Atlas - A part of report of Expert Group.

RS. 1.5.Elective 1.

C. Satellite Meteorology, Agriculture and Oceanography

Unit-1

1. Fundamentals of Remote Sensing in Meteorology
2. Meteorological satellite characteristics and their orbits, TIROS, NIMBUS, NOAA, TIROS N, SEASAT, GOES, METEOSAT, INSAT, OCEAN SAT. Role of LANDSAT, SPOT and IRS in collecting meteorological, agricultural and oceanographic data.
3. Measurement of Earth and Atmospheric energy and Radiation budget parameters from satellites.
4. Atmospheric temperature retrieval techniques and surface radiation studies.
5. Wind measuring techniques from satellite data.

Unit-2

1. Cloud classification techniques.
2. Satellite Remote Sensing System of use in rainfall monitoring methods: Cloud indexing method, Life-history method and Bio-spectral methods.
3. Interpretation of Satellite meteorological images for weather systems and cyclones.
4. Remote Sensing techniques for estimation of soil moisture and evapotranspiration.
5. Spectral behavior of different crops and vegetation in VIS, NIR, MIR, TIR and Micro-wave regions.

Unit-3

1. Principles of crop identification and area estimation, sampling techniques, vegetation indices and crop yield modeling using Remote Sensing.
2. Water management in command areas - monitoring, assessing crop water availability, demand and utilization pattern through Remote Sensing.
3. Crop stress assessment and monitoring - droughts and floods.
4. General concept of water resource assessment and irrigation water management, water logging and water quality.

Unit-4

1. Principles of Remote Sensing of Sea
2. Visible wavelength ocean - color sensors: introduction to color sensors on Landsat, Coast zone color scanner (CZCS) on Nimbus, application and oceanographic uses of Land sat and CZCS data.
3. Introduction to infrared scanning radiometers, atmospheric correction and Sea - Surface temperature calibration techniques, interpretation and uses of SST data from satellites.

4. Passive microwave radiometers: Physical principles of passive microwave radiometry microwave radiometer design and oceanographic interpretation of microwave data.

Unit-5

1. Satellite altimetry of sea - surface topography: Application of altimetry to the study of ocean currents, tides, bathymetry and wave heights.
2. Active microwave sensing of sea-surface roughness: Introduction to the Remote Sensing of sea-surface roughness, radar reflection from sea surface, surface films and oil slicks, dynamical and artificial causes of sea surface roughness patterns.
3. Introduction to Synthetic Aperture Radar, Principles of operation, SAR imaging of ocean waves, observations of ocean waves with Seasat SAR, Interpretation of ocean waves.
4. Introduction to microwave scatter meters, oceanographic application of scatterometer data. Application of wind and wave scatterometry.

List of Text Books

1. Applied Remote Sensing C.P.L.O., Longman Scientific and Technical Publishers.
2. Introduction to Environmental Remote Sensing, E.C. Barrett & L.F Curtis, Chapman and Hall, London.
3. Remote Sensing in Hydrology, Engman, E.T. and Gurney, R.J.
4. Remote Sensing in water management in command areas, Govardhan, V.
5. Satellite Oceanography - An introduction to oceanographers and Remote Scientists, I.S. Robinson, Ellis Horwood Limited, Chichester.

Reference Books

1. Applications of Remote Sensing in Agriculture. M.D. Steven and J.A. Clark.
2. Remote Sensing methods and applications, Hord, R. Michael.
3. Satellite meteorology - Bramdi, Henoy Willnois; Air weather service, 1976.
4. Satellite Meteorology - An introduction, Stanley Q. Kidder and Thomas, H. Vonder Haar - Oxlando, Academic Press, 1995.
5. Environmental satellites,; systems data interpretation and applications, Jimmie D. Johnson, Frances, C. Parmenter, Ralph Anderson, Department of Commerce, NOAA.
6. The use of satellite data in rainfall monitoring, E.C. Barrett and D.W. Martin, Academic Press, New York.

RS. 1.6. Elective.2

A. Mathematical Morphology in Image Processing
B. Water Resources Management
C. Geoinformatics for Earth Science Applications

A. Mathematical Morphology in Image Processing

Unit 1: Introduction

Overview of mathematical morphology-Basic set theory and logical operations-Euclidean space- continuous and discrete space-Image Representation-Image and grey level images-shapes-quantisation-shape-binary images- translation-rotation-scaling. Mathematical Morphology-Binary Mathematical Morphology-Erosion, Dilation, Opening, Closing

Unit 2: Mathematical morphology transformations and algorithms

Hit or Miss Transformation-Basic morphological algorithms-boundary extraction-region filling-Convex Hull-Thinning-Thickening- Medical axis transforms-Digital Skeletons-Grey Scale Mathematical Morphology-Greyscale Erosion-Grey Scale dilation-Grey Scale Opening and Closing-Application of grey scale morphology-(Non-Linear filtering techniques)-Morphological Smoothening-Morphological gradient-Black and White Top-Hot transformations.

Unit 3: Morphology based Image Classification & Applications

Binary and Grey level image segmentation-Skeletization by Zone of Influence Technique-Watershed segmentation technique-Watersnakes and PDE based-Textural segmentation-Applications of segmentation techniques in remotely sensed data classification-Segmentation of SPOT, RADARSAT, ERS SAR, and IRS data-Morphology based noise removal techniques for Microwave remote sensing data analysis-Granulometries for feature analysis
Morphology for DEM analysis and terrain characterization

Unit 4: Shape Representation by morphology and shape description

Exact dilations-Distance-transformations-Exact distance transforms through exact dilations-Vornoi Diagrams (Graph Theory)-Scale space skeletonization-Multi-scale morphological transformations-Shape Characterization-Perimeter-area-Centroid-Maximal and minimal distances to centroid- Distance to the boundary-Diameter-Maximum chord-Polygonal approximation based shape decomposition-Pattern spectrum procedure.

Unit 5: Recent Advances in Mathematical Morphology in Image processing and analysis

Fuzzy Morphology-Watersnakes and PDE based morphology, Energy minimization concepts-Theoretical graylevel morphology-Lattice theory-Discrete topology and metrics for image processing-nonliner image filtering-connected operators-geometrical scale space-topographical sgmentation-random sets and geometrical probability-integral geometry and geometrical measures-morphology applications in image sciences.

References:

1. J. Serra, Image Analysis and Mathematical Morphology, Academic Press (London), 1982, p. 610
2. C. R. Giardina and Edward Dougherty, Mathematical Morphology in Image and Signal Processing, Prentice Hall, New Jersy, 1988.

Suggested Reading

1. Gonzalez, Digital Image Processing
2. R. M. Haralick, and L. G. Shapiro, Computer and Robot Vision, Addison Wesley, Reading, v. 1, 1992, p. 453-507.
3. Technical Periodicals: IEEE Geoscience and Remote Sensing, IEEE Pattern Analysis & Machine Intelligence, IEEE Image Processing, IEEE Signal Processing

RS. 1.6. Elective.2

B. Water Resources Management

Unit-1 (Watershed Concept)

a) Issues in watershed management - land degradation, agricultural productivity, reservoirs sedimentation, depletion of bioresources, floods and droughts. Principles and approaches - principles of watershed management, different approaches in watershed management; Problem oriented approach, three dimensional approaches, integrated approach, steps in watershed management.

b) Watershed characteristics - size, shape physiography, slope, climate, drainage, landuse, vegetation, geology, soils, hydrology, hydrogeology, socio-economics. Linear aspects of channel systems - Aerial aspects of drainage basins.

Unit-2 (Land Management)

a) Survey, layout ; Preparation and Development. Contour demarcation, Bush clearance, updating, stone picking and packing, leveling, shaping and consolidation, fencing, ploughing; soil and soil moisture conservation. Soil survey; conservation measures. Contour techniques, ploughing, furrowing, trenching and staking, Gully control. Pervious check dams. Burshwood dam, Rockfill dam, Gabion; Impervious check dams.

b) Land capability classification, land degradation and problem soils. Reclamation of saline soils, alkaline soils, saline soils, acidic soils, sulphide soils; sediment yield modeling and watershed prioritization. The universal soil loss equation, sediment yield index method, statistical regression model, the European soil erosion model; Site selection from conservation measures.

Unit-3 (Water Management)

a) Surface water - Study of rainfall, estimation of run-off at micro catchments, stream gauging; Rainwater harvesting; catchment, harvesting, harvesting structures, Ground water - exploration of canal command areas, potential areas; integrated water resources management, conjunctive use.

b) Dry land Agriculture - Runoff agriculture, micro catchment forming, irrigation with saline water, reusing water, conserving water, sprinkler irrigation, drip irrigation, pot irrigation, other systems, reducing crop land percolation losses, reducing transpiration losses, selection of water use efficiency crops.

Unit-4 (Integrated Management)

a) Agriculture - Crop husbandry, soil enrichment, inter mixed and strip cropping, cropping pattern; sustainable agriculture, Hybrid and improved seeds; Biomass management, crop rotation, legumes, organic fertilization, spider farming, pastures and silvipastures; horticulture; tree culture; form forestry; bund utilization, boundary plantation; social forestry; Energy - Renewable resource, water power, solar energy wind power; biomass, fire wood, synthetic fuels, burning of municipal / garbage, ocean tides and waves.

b) Appropriate Technology - farm equipment; Contour methods; check dams, water catchment and harvesting; kunds, depression harvesting, harvesting below ground level, harvesting below stream bed level, ground water harvesting; low cost technology, water conservation, utilization of wasted natural resources, Novelities; Rural technological delivery systems, cultivating wasted lands, tree culture, farm forestry, silvipastures, horticulture, social forestry, afforestation, wonder ways.

Unit-5 (Monitoring and Evluation)

a) People's Part - awareness, participation, Response; State and integrated approach, appreciation of the concept, training, transfer of technology, resource and development, Agro-industrial infrastructure; sustainable society, livestock, small animal farming, pisiculture, sericulture, Health and hygiene education, transport, cues.

b) Monitoring and Evaluation - purpose of monitoring and evaluation, nature of monitoring and evaluation - an interative dynamic Process, design of monitoring programs - determining information needs, setting information-need priorities,

Determining means of collecting information, Information management in monitoring programs; monitoring biophysical data, monitoring socio-economic data, monitoring project activities and outputs, design of evaluation procedures, types of evaluation, focus of evaluation, reporting evaluation results, insuring use of monitoring and evaluation information, a final word of caution.

Text Books and References

1. Watershed Management, J.V.S. Murthy - Publishers; New Age International (P) Ltd., New Delhi.
2. Space Technology Applications for Sustainable Developments at Watersheds, Technical Report, ISRO-HQ-TR-104-95, ISRO, Bangalore.
3. Watershed Management Project Planning, Monitoring and Evaluation; A Manual for the Asian Region - Asian-US Watershed Project - Forestry for sustainable Development Program. University of Mirnesota, College of Natural Resources, St. Paul Mirnesota, U.S.A.

RS. 1.6. Elective.2

C. Geoinformatics for Earth Science Applications

Unit – I: Remote sensing applications in lithological studies

Introduction; Scope for Geological applications in multispectral data, Thermal Data, Microwave data Mapping of Broad scale Lithological Units in General, Igneous, sedimentary and metamorphic rock, Identification of Mineral Assemblage, their physical properties mode of origin and mode of occurrence; Lithological mapping using aerial photos and satellite imagery, Digital analysis for lithological discrimination

Unit – II: Remote Sensing applications in structural analysis

Bedding and simple dipping strata, Folds, Faults, rift zones, Lineaments, Unconformity, Structural mapping – structural analysis through aerial- and satellite- data, digital techniques for structural analysis.

Unit- III: Remote sensing application in geomorphology

Nature and type of landforms like denudational, structural, fluvial, marine, Aeolian, glacial and volcanic

Unit – IV: Remote sensing application in geological investigations

Remote sensing in Mineral Exploration, Main types of Mineral Deposits and their surface indications, Stratigraphic & lithological Guides, Geomorphological guides, Structural guides, Guide formed by Rock alteration, Geobotanical gudes. Groundwater, Petroleum,. Hydrogeological mapping, Engineering Geological studies, Land slide studies and disaster management studies using Remote Sensing and GIS techniques – case studies

Unit- V: Engineering and Sub-surface exploration & Disaster Assessment

Engineering geological Investigations: river valley projects, dams and reservoirs, route location (high ways and Rail ways) canal and pipeline alignments; neotectonism, seismic hazard and damage assessment, local ground condition, disaster assessment, volcanic and geothermal Energy applications, volcanic mapping and monitoring, identification of coal fires; environmental geology

Resistivity, aeromagnetic and electromagnetic survey for subsurface explorations

Textbooks

Ravi P.Gupta, Remote sensing Geology-Springer Publisher,A1 Books Co.in.
Joseph Lintz (Jr) and David Simonett Remote Sensing of environment, Addison Wesley Publishing Company London, 1976.
Parbinsingh Geology Katson Publishing House Ludhiana 4th edition 1985.
Manual of Remote Sensing Vol. II, American Society of Photogrammetry falls church virginia – 1985.
Three Dimensional Applications in Geographical Information Systems – by Jonathan Raper, Dept. of Geology, Birkbeck College, University of London – 1989.

RS 1.7 Photogrammetry and Photo interpretation Practical

PG.1. Testing stereo vision
PG.2. Use of Lens stereoscope and Mirror stereoscope
PG.3 Determination of vertical exaggeration
PG.4. Use of Parallax Bar for height calculation from aerial photographs
PG.5.Calculation of scale of the photographs, Marking Principal point and conjugate principal point on the stereopairs
PG.6. Preparation of aerial mosaics
PG.7. Interpretation of aerial photographs for identification of landforms of fluvial, Aeolian, glacial, coastal, volcanic and arid processes
PG.8. Identification of tectonic elements from aerial photographs
Digital photogrammetry – digital image matching and collection of mass points
Construction digital terrain models
PG.9. Application of DTMs – contour generation; fill; fly though; slope and aspect; viewshed analysis; watershed and drainage extraction; volumetric analysis; preparation of orthoimages.

RS 1.8 Remote sensing and image Interpretation Practical

RS:P1 Study of Satellite Image Annotation (information) LANDSAT, SPOT and IRS and Referencing Scheme (Analog)
RS:P2 . Study of Digital Referencing Scheme (NRSC/Digital globe/space imaging etc).
RS.P3 Understanding of Spectral Response Pattern of different Land cover objects 1 & 4
RS.P4 Study of Given Area in B/W IR, Colour and IR colour Photographs (IKONOS IIRS area)
RS. P5 Study of Satellite Imagery (B/W) in Different bands and Visual Interpretation (Landsat 6 band data for Visakhapatnam)
RS.P6- Study of Thermal Image, Interpretation of Various Features-
RS.P7- Study of Radar (Microwave) Imagery and Interpretation of Features
RS.P8- Study of Radar And SAR (Microwave) Imagery And Interpretation of Features-
RS.P9 . Interpretation of Cultural Details From high resolution imagery
RS.P10 . Digital Interpretation and preparation of Land use Map at 1:50,000 scale
RS.P11. Field exercise on visual Image interpretation and validation using ground data

II-SEMESTER

RS 2.1 - Digital Image Processing and Interpretation

Unit-1

a) Introduction - Image processing display systems.
b) Initial statistical extraction - univariate and multivariate statistics, histogram and its significance in remote sensing data.
c) Preprocessing - Introduction, missing scan lies, desk tripping methods, geometric correction and registration, atmospheric corrections, illumination and view angle effects

Unit-2

a) Image reduction, image magnification, contrast enhancement; linear, non-linear, rationing, edge enhancement; linear, non linear. low pass filters, high pass filters, edge detection, point and neighborhood operation
b) Image transform - Arithmetic operations' based image transforms, principle component analysis, discriminate analysis. Fourier transforms, Fast Fourier frequency domain filters and vegetation indices.

Unit-3

a) Image compression fundamentals: Coding, interpixel and Psycovisual redudency, and fidelity criteria.
b) Image compression models: Source encoder and decoder, channel encoder decor
c) Elements of information theory: Measuring information, the information channel fundamental coding theorems and using information theory.

Unit-4

a) Image segmentation: Detection of points, lines and edge detection and combined detection
b) Edge linking and boundary detection: Local processing, Global processing via Hough transform
c) Thresholding: foundation, role of illumination, simple global thresholding, optimal thresholding . Split and merge and Texture based Segmentation.

Unit-5

a) Classification - Geometrical basis of classification, unsupervised classification, supervised classification techniques - training sample selection, parallelepiped classifier, centroid classifier, maximum likelihood method, Hybrid methods and decision - tree classifiers. Use of external data, contextual information, feature - sub-feature study, classification accuracy.
b) Change detection - the nature of change detection, change detection algorithms, image differencing, and image rationing and classification comparisons.
c) Hyper spectral remote sensing, Imaging Spectroscopy, Data Processing techniques-N-Dimensional Scatter plots, Spectral angle mapping, Spectral mixture analysis

List of Text Books

1. Introductory digital image processing - A Remote Sensing perspective, John R.Jenson, Prentice Hall, 1986.
2. Raja Raman V., Elements of Parallel computing, Prentice Hall, 1990.
3. Charles R. Giardina and Edward R., Doloughenly, Morphological Methods in Image and Signal processing, Prentice Hall.
4. Computer Processing of Remote Sensed Images, Paul M. Mather, John Wiley & Soins, 1987.
5. Rosenfeld A. and A.C. Kak, Digital Picture Processing, New York – Academic Press, 1976.
6. Pratt. W.K. Digital Image Processing Wiley Intersciences, 1976.
7. Kalhwang and Douglas Degroot, parallel processing for super computers and artificial intelligence, McGraw-Hill, 1980.
8. Rafael C. Gonzalez, Richard E. Woods Digital Image Processing, 1993.

RS 2.2 - Remote Sensing Applications

Unit-1

1. Scope of Remote Sensing applications - potentials and limitations
2. Resource mapping and integrated information for sustainable development
3. Resource evaluation: Soils, minerals forest and agriculture.

Unit-2

Applications in land use and land cover analyses

1. Land use classification principles and systems
2. Mapping and monitoring of land use / land cover and regional planning
3. Urban land use, Urban sprawl and urban planning.

Unit-3

Water Resource Applications

1. Mapping, monitoring of surface water bodies, tanks, lakes / reservoirs
2. Hydrogeomorphic mapping, ground water zoning from unconsolidated, semi-consolidated and hard rocks.

Unit-4

Coastal and near shore applications

1. Satellite sensors for Coastal zone environment
2. Coastal landforms and evolution
3. Coastal dynamics and shore line changes and Coastal wetlands

Unit-5

Environmental and disaster management applications

1. Mapping and monitoring of Natural hazards
   a) Cyclones / floods b) Droughts c) Landslides
   d) Volcanoes e) Earthquakes
2. Analysis of human-induced hazards
   a) Deforestation b) Erosion c) Siltation

Text Books

1. Applied Remote Sensing, C.P. Lo, Longman, Scientific and Technical Publishers
2. Remote Sensing in hydrology, Engman, E.T. Gurney, R.J.
3. Remote Sensing in water management in command areas, Govardhan, V.
4. Satellite oceanography, An introduction for oceanographers and Remote Sensing Scientists, I.R. Robinson, Ellis Horwood series marine sciences.
5. Remote Sensing - Principles and Interpretation, Sabins F.F. Freeman & Co., 1987.

Reference material

4. Satellite meteorology Techniques and applications, Vol. I and Vol. 2, Edited by B.M. Rao, et. al.

RS 2.3 - Geographic Information Systems

Unit-1: Fundamentals of GIS

a) Introduction to GIS, Understand the difference between GIS and information system in general, GIS components and function of GIS: hardware software requirement of GIS, data types and spatial data models, idea of conceptual, logical and physical models, RDBMS, data base normalization Representation of real world via vector and raster representation model.
b) Definition of a map Geographic data in the computer. File and data processing, data base structures, perceived structures and computer representation and geographical data. Raster data structure, Vector data structures for geographical entities.

Unit-2 Data input and Quality verification

a) Data input, verification, storage and output: Data input, data verification, and correction and storage data output; data user interfaces.
b) Data Quality, Errors and Natural Variation: Sources of error, Errors resulting from natural variation of from original measurements. Errors arising through processing, problem; and errors arising from overlay and boundary intersections. Errors resulting room rasterizing a vector map. Errors associated with overlaying two or more polygon networks. The nature of boundaries. The statistical nature of boundaries. Combining attributes from overlaid maps.

Unit-3 DEM & Map Projections

a) Digital Elevation Models: The need of DEMs, methods of representing DEMs. Image methods, data sources and sampling methods for DEMs. Products that can be derived from a DEM. Automated landform delineation from DEMs.
b) Map projections in GIS

Unit-4 Data Analysis

a) Vector & Raster based analysis: Attribute data analysis, Integrated spatial and attribute data analysis: Single and multi layer raster and vector analysis, map overlay, spatial join, buffering analysis, network analysis, that is optimum path,(cost/time/distance, Travelling sales man problem, Dijkstras's algorithm, geometric networks) Raster data analysis: Local, Neighborhood and regional operations.
b) Methods of Data Analysis and Spatial Modeling: Introduction, definition of the database. Simple data retrieval. A general approach to map overlay, Cartographic modeling using natural language commands. Linking command sequences into cartographic models, advantages and disadvantages of cartographic modeling in land evaluation and planning.

c) Methods of Spatial interpolation. The available methods for interpolation, global methods of interpolation, location interpolators, optimal interpolation methods using spatial auto covariance. Extensions of krigging to large areas. Comparing krigging with other interpolation techniques. Choosing a Geographic Information System. Designing the needs for GIS.

Unit-5 Technological trends in GIS

a) Tools for Map analysis: Single maps, Map reclassification, operations and attribute tables, spatial topological and geometric modeling and operations on spatial Neighborhood. Tools for map Analysis: Map pairs, map overlay and map modeling correlation between two maps. Tools for map analysis: Multiple maps, types of models, Boolean logic models, Index overlay models, Fuzzy logic methods.

b) GIS customization, Data warehousing, cloud GIS, data mining, OLAP, SDSS, distributed, parallel and GPU, spatial data infrastructure,(i.e. integration and standards etc.,) Free and open source tools and web resources, Introduction to spatial decision problems, GIS and decision support system, over view of Internet GIS , Location based services.

List of Text books

1. Principles of Geographical Information System for Land Resource Assessment, P.A. Burrough, Clarendon Press, Oxford, 1986.
2. Geographic Information Systems, T.R. Smith & Piqent, London Press, 1985.
3. Principles of data base systems, J.D. Ullman, Computer Science Press.
4. Longly, Paul A., Goodchild, Michael F., Maguire, David J., and David W. Rhind.(2005) Geographic Information System and Science, @nd ed., John Wiley and sons, Toronto.

5.Marguerite, Maddm, (2009). Manual of Geographic Information system, ASPRS, 2009

Web Sites

1. http://www.gespatialworld.net
2. www.earthmapping.com/
3. http://www.esri.com//
4. http://www.innovativegis.com/basis/

RS 2.4 - ADVANCES IN REMOTE SENSING

Unit-1

1. Introduction to Hyperspectral Remote Sensing
2. Spectral consideration
3. High resolution spectral features
4. Hyperspectral sensors

Unit-2

1. Airborne hyperspectral sensors
2. Space borne hyperspectral sensors
3. Processing of hyperspectral data
4. Procedures of data analysis

Unit-3

1. Principles of LIDAR
2. Laser and scanning system
3. Extraction of DSM
4. Analysis of LIDAR data

Unit-4

1. Fundamental concepts of GPS
2. Various segments and observation principles
3. Structure, basic concepts of GPS receiver and its components
4. Classification of GPS receivers.

Unit-5

1. Applications of hyperspectral remote sensing
2. LIDAR derived vegetation
3. LIDAR derived urban environment
4. Applications of GPS in surveying and resource inventory

TEXT BOOKS

1. Elachi, C.: introduction to the Physics and Techniques of Remote Sensing, Wiley Interscience, 1987.
2. John R.Jenson: Remote sensing of the environment
3. Thomas M. Lillesand, Kiefere and Jonathan W.Chipman: Remote Sensing and Image interpretation, John wiley, 2004.
4. Manual on GPS-Canada GS Publication
5. Marcus Borengasser, William S. Hungate and Russell Watkins: Hyperspectral Remote Sensing Principles and Applications

R.S.2.5 Elective-I

A. Geoinformatics for Environmental Monitoring

B.Watershed Management and Analysis

C. Urban Planning and Information Systems

A. Geoinformatics for Environmental Monitoring

Unit –1 Water and the Environment

Remote sensing of fluorescence – water quality – water pollution – potential pollution sources – water runoff, Remote Sensing and Water quality management – snow surface cover – flood prediction. Soils and land forms – insects and disease – soil erosion – salinity – flood damage – soil limitation – soil degradation using Remote Sensing and GIS.

Unit –II Urban Environment

General consideration rural structure – Urban areas – Impact of industrial pollution – chemical effluents, land reclamation – disposal of solid waste – mining pollution

Unit- III Marine Environment

Sensors for environmental monitoring – sensors – visible and outside visible wave length – absorption spectrometers – selection of ground truth sites – sea truth observations – Radar techniques for sensing ocean surface – thermal measurements – application of sensing, mapping oil slicks – Chlorophyll detection – Fisheries resources – Coastal marine studies – determination of temperature and sea state.

Unit –IV Air pollution and Global Climatology

Remote sensing techniques for Air quality monitoring – case studies – weather forecasting and climatology – emissivity characteristics – measurement of atmospheric temperature – composition – constituent distribution and concentration – wind flows and air circulation – Hurricane tracking – meteorological satellite systems.

Unit –V Case studies

River pollution – the case of Ganga River

Air Pollution in Delhi; Mathura Refinery and Taj Mahal; Marine pollution in Visakhapatnam; Urbanization and its impact on Visakhapatnam city environment

References

Baretl, E.C. and Culis I.F. Introduction to Environmental Remote Sensing, second edition, Chapman and Hall, New York, 1993

Lintz, J. and Simonent, D.S. Remote Sensing of environment Addision Wesley, Rading mars, 1976

R.S.2.5 Elective-I

B.Watershed Management and Analysis

Unit-1 (Watershed Concept)

c) Issues in watershed management - land degradation, agricultural productivity, reservoirs sedimentation, depletion of bioresources, floods and droughts. Principles and approaches - principles of watershed management, different approaches in watershed management; Problem oriented approach, three dimensional approaches, integrated approach, steps in watershed management.

d) Watershed characteristics - size, shape physiography, slope, climate, drainage, land use, vegetation, geology, soils, hydrology, hydrogeology, socio-economics. Linear aspects of channel systems - Aerial aspects of drainage basins.

Unit-2 (Land Management)

c) Survey, layout ; Preparation and Development. Contour demarcation, Bush clearance, updating, store picking and packing, leveling, shaping and consolidation, fencing, ploughing; soil and soil moisture conservation. Soil survey; conservation measures. Contour techniques, ploughing, furrowing, trenching and staking, Gully control. Previous check dams. Brushwood dam, Rock fill dam, Gabion; Impervious check dams.

d) Land capability classification, land degradation and problem soils. Reclamation of saline soils, alkaline soils, saline soils, acidic soils, sulphide soils; sediment yield modeling and watershed prioritization. The universal soil loss equation, sediment yield index method, statistical regression model, the European soil erosion model; Site selection from conservation measures.

Unit-3 (Water Management)

c) Surface water - Study of rainfall, estimation of run-off at micro catchments, stream gauging; Rainwater harvesting catchment, harvesting, harvesting structures, Ground water - exploration of canal command areas, potential areas; integrated water resources management, conjunctive use.

d) Dry land Agriculture - Runoff agriculture, micro catchment forming, irrigation with saline water, reusing water, conserving water, sprinkler irrigation, drip irrigation, pot irrigation, other systems, reducing crop land percolation losses, reducing transpiration losses, selection of water use efficiency crops.

Unit-4 (Integrated Management)

c) Agriculture - Crop husbandry, soil enrichment, inter, mixed and strip cropping, clopping pattern; sustainable agriculture, Hybrid and improved seeds; Biomass management, crop rotation, legumes, organic fertilization, spider farming, pastures and silvipastures; horticulture; tree culture; form forestry; bund utilization, boundary plantation; social forestry; Energy - Renewable resource water power, solar energy wind power; biomass, fire food synthetic fuels, burning of municipal / garbage, ocean tides and waves.

d) Appropriate Technology - Farm Equipment; Contour Methods; Check Dams, Water catchment and Harvesting, Kunds, Depression Harvesting, Harvesting below ground level, Harvesting below stream bed level, Ground water harvesting; low cost technology, Water Conservation, Utilization of Wasted Natural Resources, Novelties; Rural Technological Delivery Systems, Cultivating Wasted Lands, Tree Culture, Farm Forestry, Silvipastures, horticulture, Social forestry, afforestation, wonder ways.

Unit-5 (Monitoring and Evaluation)

c) People's Part - Awareness, participation, Response; State and integrated approach, Appreciation of the concept, training, transfer of technology, Resource and Development, Agro-industrial infrastructure; Sustainable society, livestock, small animal farming, pisciculture, sericulture, Health and hygiene education, transport, cues.
d) Monitoring and Evaluation - Purpose of Monitoring and Evaluation, Nature of Monitoring and Evaluation - An interactive dynamic Process, Design of Monitoring programs - Determining information needs, Setting information-need priorities, Determining means of collecting information, Information management in monitoring programs; Monitoring Biophysical Data, Monitoring Socio-economic Data, Monitoring Project Activities and outputs, Design of Evaluation Procedures, Types of Evaluation, Focus of Evaluation, Reporting Evaluation Results, Insuring Use of Monitoring and Evaluation Information, A Final Word of Caution.

Text Books and References

4. Watershed Management, J.V.S. Murthy - Publishers; New Age International (P) Ltd., New Delhi.
5. Space Technology Applications for Sustainable Developments at Watersheds, Technical Report, ISRO-HQ-TR-104-95, ISRO, Bangalore.
6. Watershed Management Project Planning, Monitoring and Evaluation; A Manual for the Asian Region - Asian-US Watershed Project - Forestry for sustainable Development Program. University of Minnesota, College of Natural Resources, St. Paul Minnesota, U.S.A.

R.S.2.5 Elective-I

C. Urban Planning and Information Systems

Unit – I Introduction

Planning: background and principles; Need for planning; Urbanisation and its impact, Distribution of land use/land cover; Town planning in ancient India and new towns of India; Requirements and possible types of development of towns; Geoinformatics application in Urban Planning

Unit II Formulation of Plans

Objectives and contents; Regional plan; Perspective plan; Master plan; Development plan; Project (scheme) plan; Delineation of planning area; Trend analysis; Land suitability analysis; Land use planning; Zoning and principles of zoning; Building Bye-laws and its principles; Requirement of urban & regional planners; Remote sensing for different levels of development planning

Unit – III Housing

Importance of housing; urban housing demand and production; Slums and squatters; Housing problem in India; National Housing policy; Site analysis - Layout design; Housing projects / Slum housing; Urban renewal projects; Urban infrastructure planning

Unit – IV Transportation planning

Classification of urban roads; Traffic surveys: speed, time, delay surveys; Use of speed, journey time and delay studies; Traffic volume; Origin Destination surveys; Parking surveys; Utility of remote sensing in traffic and transportation studies

Unit – V Urban Information System

Information system: Land; Housing; Transportation; Infrastructure; Trends in mapping using remote sensing, GIS and GPS; Database creation for Infrastructure development Decision support system for urban and regional management

R.S. 2.6 Elective-2

A.Digital Photogrammetry and Mapping

B.Geoinformatics for Resources Development and Disaster Management

C.Spatial Database Handling Modelling & GIS Implementating Architectures

A. Digital Photogrammetry and Mapping

Unit 1 : Geodesy and Surveying

Fundamentals of geodesy, Geodetic reference systems: ICRE, ITRF, Geoid and geoidal heights and undulations.Geodetic datum and datum transformation, Map projection and transformation.Techniques of ground survey (horizontal and vertical control,triangulation, traversing, leveling, GPS and Total Station surveying). Data integration from different sources (GPS, Total Station, High resolution satellites) for large scale mapping and cadastral surveys.

Unit-II

GNNS: Carrier phase measurements, Signal structure, GNNS Errors and biases, Differential Positioning –concepts and principles, IGS station-final ephemeris, differential corrections, accuracy in differential satellite positioning system PS, local area DGPS, wide area DGPS, LAAS, WAAS,GAGAN, Mapping methods with GPS – rapid static method, semi-kinematic method, kinematic method. Real time DGPS. GNSS, GLONASS, IRNSS, GALILEO, Beidou, and future prospects of navigational satellites

Unit-III: Aerial and Satellite Photogrammetry

Photogrammetric camera (digital), Imaging systems- Asynchronous imaging, multiline scanners, multiple camera/multi sensors, area scanners, panoramic linear array scanners, wide field camera, Imaging properties, Theory of orientation: (IO, RO and AO) .

Photogrammetric Triangulation: Single image, Stereo-pair (two overlapping images), Strip triangulation, Block Adjustment of Independent Models (BAIM), Bundle Block Adjustment, Special cases (resection, intersection, and stereo-pair generation).

Satellite Photogrammetry: Orbital Parameters, Orbital Modeling, Data Processing for stereo generation (block triangulation, optimum control requirement), Space Resection and

Intersection, Solutions and differences in different sensor models for photogrammetric processing. Processing of IRS IC/ID, CARTOSAT, ASTER, ALOS PRISM, SPOT, IKONOS, Quick Bird etc.

Unit IV: Close Range Photogrammetry

Principles of CRP, Cameras for Close Range Applications, Data Acquisition, Camera Calibration, Data Processing, Surface Generation, Validation, Terrestrial Laser Scanners and future prospects.

Unit V: Digital Cartography and Visualization

Geo Spatial Data Base organization, Digital Cartography, Web Cartography, 3D Simulation and Visualization, Digital earth models and data dissemination services: contemporary approaches (Bhuvan and Google Earth) and future prospects.

Suggested Readings:

Books and Reports

1. Toni Schenk: Digital Photogrammetry, Volume I., TerraScience.
2. Sanjib K. Ghosh, (1979): Analytical Photogrammetry, New York: Pergamon Press
3. Sanjib K. Ghosh. (2005). Fundamentals of computation Photogrammetry. Concept Publishing,
New Delhi.
4. Luhmann, Thomas, Robson, Stuart and Kyle, Stephen, (2007). Close Range Photogrammetry:
Principles, Techniques and Applications. Wiley, 2007. 528. ISBN : 978047010633.
5. Kasser Michel and Egles Yves, (2002). Digital Photogrammetry. London: Taylor and Francis,
2002. XV, 351 p..
6. Wolfgang Torge, W., Geodesy, 3rd edition
7. Robinson H. Arthur, Morrison Joel L. and Muehrcke Phillip C. (1995). "Elements of Cartography, 6th ed., John Wiley and Sons, Inc, 671p.
8. Slocum Terry A, (1999). Thematic Cartography and Visualization. New Jersey: Prentice - Hall Inc., 1999. 293p.
9. Kraak Menno-Jan and Ormelling, Ferjan (2003): Cartography: Visualization of geospatial data. 2nd (ed.) Harlow: Prentice Hall, IX, 205p.
10. Kraak Menno-Jan (Ed.) and Brown Allan (Ed) (2001). Web Cartography: Developments and Prospects. New York: Taylor & Francis, IX, 213 p.

Textbooks

- Rangwala, Town Planning, Charotar Publishing House, Anand, India
- Gallian B. Arthu and Simon Eisner, The Urban Pattern, City Planning and Design. Affiliated Press Pvt. Ltd., New Delhi 1985.
- Margaret Roberts, Ana Introduction to Town Planning Techniques, Hutchinson, London, 1980.

R.S.2.6 Elective-2

B. Geoinformatics for Resources Development and Disaster Management

Unit I

Natural Resources Development: Introduction and Scope: role of geoinformatics technologies – aerial photographs; satellite remote sensing; GPS; and GIS in resource evaluation
Water resources – surface water and groundwater resources: mapping and monitoring of watersheds, tanks and reservoirs; hydrogeomorphic mapping and identification of groundwater potential zones
Ocean resources: estimation of sea-surface temperature; primary productivity and potential fishing zones

Unit II

Soil and agricultural resources: Spectral behavior of soils; Mapping of soils using multispectral images; Evaluation of soil erosion prone zones through GIS; Remote sensing in Land use / land cover mapping; Crop area estimations; monitoring of crop vigour; Yield estimations.
Forest resources: mapping of forest types; estimations of timber volume; monitoring of forest health – forest pests, forest fires, Trends in deforestation and afforestation.

Unit III

Remote sensing techniques for identification of rocks and minerals; mapping of geological structures; surface manifestation of minerals and their identification; spectral properties of minerals; role of thermal and hyperspectral remote sensing in mineral exploration. Case studies

Unit IV

Geoinformatics in Disaster Management: introduction and scope
Coastal Hazards: Storm surges and Tsunamis: Origin, propagation and run-up;
Role of coastal topography, bathymetry and vegetation;
Coastal hazard preparedness –Role of geoinformatics in coastal hazard mapping, risk and vulnerability assessment and evacuation analysis; coastal protection, education and awareness of coastal communities

Unit V

Geoinformatics applications in disaster mapping and mitigation; Risk zone mapping: earthquakes – identification of geological structures like faults; volcanic activity – thermal imaging for monitoring temperature changes; Geoinformatics analysis of potential zones for landslides; avalanches; and floods. Mapping of disaster affected areas for rescue and mitigation; damage assessment; GIS-based decision support systems for disaster management

Books and References:

Remote sensing for earth resources 2nd Edition, (ed) D.P. Rao, AEG Publ., Hyderabad, 1999

Geomatics solutions for Disaster Management, Li, Zlatanova and Fabbri (ed), Springer, 2007

Role of remote sensing in disaster Management, Nirupama and S.P Simonovic, ICLR Research Paper Series 21, 2002 (available at http://www.iclr.org/pdf/Niru_report%20Simonovic.pdf)

Remote Sensing imagery for natural resources monitoring: a guide for first time users, D.S. Wlike and J.T. Finn, Columbia University Press

Successful response starts with a map: Improving Geospatial Support for Disaster Management by Committee on Planning for Catastrophe: A Blueprint for Improving Geospatial Data, Tools, and Infrastructure, National Research Council, National Academies Press, 2006, ISBN: 0309103401

Applications of Remote Sensing in Agriculture, M.D. Steven and J.A.Clark, Butterworths, 1990

Tsunamis- to survive from tsunami, Susumu Murata et al., 2009 World Scientific Books

Reference

Sea-Level Rise and Coastal vulnerability – an assessment of Andhra Pradesh coast, India through remote sensing and GIS, Nageswara Rao, K. et al., (2008) *Journal of Coastal Conservation*, Vol. 12: pp. 195-207

Imperatives for Tsunami Education, Nageswara Rao, K. (2007) *Current Science*, Vol. 93 (1) pp. 8-9

R.S.2.6 Elective-2

C. Spatial Database Handling Modelling & GIS Implementating Architectures

Unit-I
Spatial Database Management System:

Database overview, attribute data model, Spatial Data
base, spatial Data Type and structures. **Spatial Database Design:** Conceptual data modelling, Concepts of UML, UML use case, Spatial data topological relationship.

Unit-II
Spatial Database:
Storage and Retrieval Concepts of spatial data storage, spatial Indexing, Basics of relational algebra, Data normalization, Spatial Query languages using extended SQL, spatial query processing and optimization.

Unit-III
GIS Implementing Architectures:
GIS Implementation architectures (desktop, client server, enterprise, mobile, web/cloud, web services from mobile platforms, spatial data acquisition / supply in distributed environment and security issues.

Unit-IV
Spatial Data Modelling 05 Spatial data modelling and its classification, spatial decision support system, spatial decision modelling concepts, AHP based modelling with case study, Agent based modelling with case study.

Unit-V
Spatial Data Mining: Overview of data mining, Concepts of Decision tree based approach with case study, Content based image retrieval concept with case study.

Suggested Readings:

Books and Reports

1. Alistair Cockburn (2001). Writing Effective Use Cases (Boston, MA Addison Wesley, 12001).
2. Date,C.J.: Database System, Tata McGraw Hill Publications.
3. Shashi Shekhar & Sanjay Chawla (2003). Spatial database: A Tour, Prentice Hall, 2003.
4. Garnady Booch, James Rumbaugh and Ivar, Jacobson (1999). The Unified Modeling language User
Guide (Boston, MA Addison Wesley, 1999).
5. Marvin V. Zelkowitz, Alan C. Shaw and John D. Gannon (1979). Principles of Software Engineering
and Design, Englewood Cliffs, NJ: Prentice Hall, 179, p5.
6. Sudha T. and M. Usha Rani: Applications of Data Mining, ISBN: 81-8356-330-7.

Journal Articles

1. Daniel G. Brown, Rick Riolo, Derek T. Robinson, Michael North and William Rand: Spatial Process and
Data Models: Towards Integration of Agent Based Models and GIS, Journal of

RS 2.7 - Digital Image Processing Practical

Programme writing in C. language for Data handling and processing of Remote Sensing data including histogram construction, scene enlargement, rationing and enhancement. Application of spatial filters; transformations, colour display techniques, Radiometric correction techniques, for existing satellites. Segmentation and classification methods: supervised and unsupervised techniques for different applications.

RS 2.8 - Geographic Information Systems Practical

1. Familiarity with D Base Commands including record updating and processing.
2. Theme representation by usage of graphics command resources data maintenance - Theme filling and retrieval and usage.

Exercise: Development / updating of data base management software packages for a selected practical problem using available GIS package.
Arc-info, Arc-View practice and ILWIS software packages
Creation of different spatial layers.
Map analysis.

III-SEMESTERS & IV- SEMESTERS
Dissertation and Viva Voce

A) Dissertation

The student for the fulfillment of M.Tech Degree in Remote Sensing must carry out individual dissertation work. Candidates can do their work in the department or in any industry/research organization for two semesters (ie 3rd and 4th semesters)

At the end of the third semester and fourth semester, an evaluation of the dissertation by the processes of viva-voce 1. (preliminary) for 100 marks and (2) a viva voce for 100 marks on the dissertation and related subjects.

B) Evaluation procedure

Progress of the dissertation/ thesis work at the end of 3rd Semester will be evaluated by a committee consisting of Chairman, Board of Studies, Head of the Department and Thesis guide.

The Final thesis at the end of 4th Semester is evaluated through defense and Viva Voce examination will be conducted to the student by the external examiner and the internal research guide along with the Head of the Department and Chairman Board of Studies, on the topic of the dissertation carried out by the student the candidate may be recommended for award of a grade such as **A** (=Excellent); **B** (=Very Good); **C** (=Good); or **F** (=Not Accepted/Failed).

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The prerequisite for submission of the M.Tech.thesis is that one should communicate his/her work to any referred journal or Publication in a conference.

For final result the dissertation credits are not added for CGPA..