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. 2013-2014 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.Sc. (Ag.)/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 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.

   C) At the end of the fourth semester, there shall be (1) am evaluation of the dissertation, and (2) a viva voce on the dissertation and related subjects.

   D) 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.

   E) 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.

   F) 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.

   G) 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 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.

M.Tech. Remote Sensing (Revised Syllabus)
Scheme of Instructions/ Examinations as per credit system w.e.f. admitted batch 2013-2014

Code No.	Name of the course	Periods per week		Examination Duration Hours	Max. marks		Credit
		Lectures	Lab.		Semester end examination	Sessional	
I SEMESTER							
RS 101	Mathematics & Statistics	4	-	3	70	30	4
RS 102	Fundamentals of Computers	4	-	3	70	30	4
RS 103	Principles of Photogrammetry and Photo interpretation	4	-	3	70	30	4
RS 104	Earth Systems	4	-	3	70	30	4
RS 105	Principles of Remote Sensing	4	-	3	70	30	4
RS 106	Computer programming in 'C' practical	-	6	3	50	50	2
RS 107	Photogrammentry and Photo interpretation practical	-	6	3	50	50	2
RS 108	Remote sensing practical	-	6	3	50	50	2
II SEMESTER							
RS 201	Digital Image Processing and Interpretation	4	-	3	70	30	4
RS 202	Remote Sensing applications	4	-	3	70	30	4
RS 203	Geographic Information Systems	4	-	3	70	30	4
RS 204	Advances in Remote Sensing	4	-	3	70	30	4
RS 205	Electives 1.Coastal Zone Management 2. Natural Disaster Management 3. Satellite Meteorology and Agriculture and Oceanography 4.Mathematical Morphology in Image Processing 5. Water Resources Management	4	-	3	70	30	4
RS 206	Digital Image processing practical	-	6	3	50	50	2
RS 207	GIS practical	-	6	3	50	50	2
RS 208	Remote sensing applications practicals	-	6	3	50	50	2
III and IV SEMESTERS							
Thesis / Dissertation / Project							30

SEMESTER I
RS 101 - 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 102 - Fundamentals of Computers

Unit-1

Introduction to Computers / Data representation, Conversion of data. Memory organization, Different secondary storage devices and Magnetic media devices - Magnetic tape; CCTs, DATs, Cartridges, Magneto-optical disks, CDs (read and write) ZIP drives, PHDs (Pocket Hard Disks), Floppies and DVDs, Blue Ray Disc.

Data Representation - Representation of Characters in Computers, Representation of Integers, Representation of Fractions, Hexadecimal Representation of Numbers, Decimal to Binary Conversion, Error Detecting Codes.

Computer Memory - Memory Cell, Memory Organization, Read-only Memory, Serial Access Memory, Physical Devices used to Construct Memories, Magnetic hard Disk, Floppy Disk Drives, Magnetic Tape Drives, Flash Drives.

Unit-2

Binary Arithmetic, Complement representation, Boolean functions, Registers, Flip Flops, I/O Devices Types and Printers.

Processor - Structure of Instructions, Description of a Processor, A Machine Language Program. An Algorithm to Simulate a Hypothetical Computer.

Logic Circuits - Introduction. Switching Circuits, And / Or Operations, NOT operation, Boolean Functions, Postulates, Duality Principle, Theorems, Precedence of Operators, Venn Diagram, Truth Table, Canonical Forms for Boolean Functions, Logic Circuits, Parallel and Serial Adders, Physical Devices used to Construct Gates, Transistors, Integrated Circuits.

Unit-3

Operating System Concepts, Structures, Files, Directories, Process and Memory management.

Unit-4

Concepts of analysis of algorithms, fundamentals of data structures, arrays, stacks and queues.

Unit-5

Fundamentals of object oriented programming concepts, Computer Graphics: Fundamentals of Computer Graphics, Fundamentals of Multimedia and applications.

Text Books

1. Fundamentals of data structures by Horowitz F and Sahani S
2. Modern Operating Systems by Andres S Tanenbanm
3. Fundamentals of computers. V. Rajaraman

RS 103 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 104 - 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

Course No. RS 105 – 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-4 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 106 - Computer Programming in 'C' Practical

1. Introduction
2. Control Statements
3. Arrays
4. Functions
5. Console Input/Output functions.
6. Pointer variables
7. Structures and Unions
8. Command line Arguments
9. File Handling in 'C'
10. Processor Devices & Standard library functions.

RS 107 Photogrammentry and Photo interpretation Practicals

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

RS 108 - Remote Sensing - Practical

Study of Remote Sensing Imagery for :

1. Identification of geological, geomorphologic and cultural forms (IRSIA & 1B)
2. Water resources studies (TMIRS & SPOT)
3. Environmental Impact assessment (SPOT)
4. The student should select a theme for visual interpretation and prepare a practical report as one of the inputs to the practical examination assessment.

SEMESTER II
RS 201 - 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 202 - 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.

Course No. RS 203 - 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-204: 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

Syllabus for Elective Subjects
Elective 1 - RS 205.1 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

Elective 2 - RS 205.2 - 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.

Elective –3 RS 205.3 Satellite Meteorology and 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.

Elective –4 R.S. 205.4 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

Elective - 5 –RS. 205.5 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 206 - 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 207 - Geographic Information Systems (GIS) 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.

RS 208 – Remote Sensing Applications Practicals

Exercises on:

1. Water Resources Mapping: surface water bodies – inventory and temporal changes; Hydrogeomorphology mapping for groundwater exploration
2. Analysis of erosion prone zones
3. Forest inventory and monitoring
4. Phynology changes and crop inventory
5. Coastal zone mapping: dynamics of coastal landforms and coastal waters
6. Spectral reflectance measurements over different objects
7. Global positioning system (GPS)- Mobile mapping.

SEMESTERS III & IV
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)

B) Evaluation procedure

Progress of the dessertation/ 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 defence 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..