M.TECH (REMOTE SENSING)

OBJECTIVES:

The course is designed to fulfill the following objectives

1. To provide exposure to students in gaining knowledge on concepts and applications leading to modeling of earth resources management using Remote Sensing
2. To acquire skills in storing, managing digital data for planning and development.
3. To acquire skills in advance techniques such as hyper spectral, thermal and LiDAR scanning for mapping, modeling and monitoring.

OUTCOME:

1. Fully equipped with concepts, methodologies and applications of Remote Sensing Technology.
2. Prepare the candidates for National and Global Employability
3. Acquire skills in handling instruments, tools, techniques and modeling while using Remote Sensing Technology
4. It empowers the candidate with confidence and leadership qualities.
# M.TECH. REMOTE SENSING

**CURRICULUM AND SYLLABUS I TO IV SEMESTERS (FULL TIME)**

## SEMESTER I

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UNIVERSITY DEPARTMENTS
ANNA UNIVERSITY :: CHENNAI 600 025
REGULATIONS - 2013

**DIRECTOR**
Centre For Academic Courses, Anna University, Chennai-600 025
### SEMESTER IV

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 70**

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UNIVERSITY DEPARTMENTS
ANNA UNIVERSITY :: CHENNAI 600 025
REGULATIONS - 2013
M.TECH. REMOTE SENSING
CURRICULUM AND SYLLABUS I TO VI SEMESTERS (PART TIME)

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TOTAL NO. OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 70

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<td>Airborne Laser Terrain Mapper (ALTM)</td>
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<td>Decision Support System</td>
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OBJECTIVES:
- To introduce the student to the physical principles of Remote Sensing and Photogrammetry as a tool for mapping
- To inform him of the data products, their properties and methods of preparing thematic information.

UNIT I INTRODUCTION TO REMOTE SENSING

UNIT II DATA ACQUISITION IN DIFFERENT PLATFORMS
Historical development - Opto mechanical electro optical sensors - across track and Along track scanners - multi spectral scanners - characteristics of different types of platforms - medium and high resolution missions - Future Missions - Data products and characteristics - formats

UNIT III DATA ANALYSIS

UNIT IV INTRODUCTION TO PHOTOGRAPEMTRY
Principles - aerial photo-aerial camera - Scale - overlaps - stereoscopy - concepts - viewing and measuring systems - image and object co-ordinates - transformation - floating mark - parallax equation - height information - Flight planning - computation for flight plan - photo control

UNIT V PHOTOGRAMMETRY AND MAPPING
Concepts of interior, relative, absolute orientation - direct georeferencing - object, image relation - collinearity and coplanarity conditions - effect of orientation elements - Elements and principles of Aerotriangulation - orthorectification - ortho mosaic - Introduction to digital photogrammetry - comparison with analytical systems - DP workstations.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Acquire knowledge about concepts of Remote sensing, sensors and their characteristics.
- Gain skills in image analysis and interpretation in preparing thematic maps.
- Acquire knowledge in basic concepts of Photogrammetry and Mapping.

REFERENCES:
OBJECTIVE:
- To understand the working of Total Station and GPS equipment and solve the surveying problems.

UNIT I  FUNDAMENTALS OF TOTAL STATION AND GPS
Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid - satellite orbital motion - Keplerian motion - Kepler’s Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept – GNSS

UNIT II ELECTROMAGNETIC WAVES
Classification - applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies - Refractive index (RI) - factors affecting RI - Computation of group for light and near infrared waves at standard and ambient conditions - Computation of RI for microwaves at ambient condition - Reference refractive index - Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction -Total atmospheric correction- Use of temperature - pressure transducers.

UNIT III ELECTRO OPTICAL AND MICRO WAVE SYSTEM

UNIT IV GPS SATELLITE SYSTEM
GPS - Different segments - space, control and user segments - satellite configuration - GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

UNIT V GPS DATA PROCESSING
GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data -data processing – software modules -solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -basic constellation of satellite geometry & accuracy measures - applications- long baseline processing- use of different softwares available in the market.
FIELD WORK
Study of Total Station, Distance and Coordinate Measurement, Missing Line Measurement, Remote Elevation Measurement, Resection, Setting out: Point and Line, Taking Offsets, Area Measurement, Total Station Traversing, Study of Hand held GPS, Study of Geodetic GPS, Static and semi kinematics survey, Differential Positioning, Precise Positioning and GPS Traversing

(L:45, P:30) TOTAL : 75 PERIODS

OUTCOMES:
On completion of this course students shall be able to
- Understanding the concepts of Electromagnetic waves and impact of RI
- Work with Electro optical and microwave Total Station and understand error sources.
- Understand the advantages of electronic surveying over conventional surveying methods
- Understand the working principle of GPS, its components, signal structure, and error sources
- Understand various GPS surveying methods and processing techniques used in GPS observations
- Familiarise various areas of GPS applications and new developments.

REFERENCES:

MA8161 STATISTICAL METHODS FOR ENGINEERS

OBJECTIVES:
- To study and understand the concepts of Statistical methods and its applications in Engineering.
- To study the effect of estimation theory, testing of hypothesis, correlation and regression, randomized design, and multivariate analysis.

UNIT I ESTIMATION THEORY
9+3

UNIT II TESTING OF HYPOTHESIS
9+3
Tests based on Normal, t, $X^2$ and F distributions for testing of means, variance and proportions – Analysis of r x c tables – Goodness of fit.

UNIT III CORRELATION AND REGRESSION
9+3
Multiple and Partial Correlation – Method of Least Squares – Plane of Regression – Properties of Residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and Partial correlations in terms of lower order coefficients.

UNIT IV DESIGN OF EXPERIMENTS
9+3
Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.
UNIT V  MULTIVARIATE ANALYSIS


L: 45 + T : 15 TOTAL : 60 PERIODS

OUTCOME:
- On completion of this course the students will be able to solve various problems in the field of engineering employing probability and statistical methods.

REFERENCES:

RS8151  GIS AND DIGITAL CARTOGRAPHY

OBJECTIVE:
- Expose the students with concepts of cartography as major components of input and output related to cartography. To provide exposure to data models and data structures in GIS and to introduce various Raster and Vector Analysis capabilities. To expose the concept of quality and design of cartographic outputs in open GIS environment.

UNIT I  MAP AND CARTOGRAPHIC PRINCIPLES

UNIT II  GIS; DATA INPUT AND DATA MODELS

UNIT III  RASTER AND VECTOR DATA ANALYSIS
UNIT IV NETWORK ANALYSIS AND DATA MANAGEMENT
Network – Creating Network Data - Origin, Destination, Stops, Barriers – Closest Facility Analysis, Service Area Analysis, OD Cost matrix analysis, Shortest Path Analysis – Address Geocoding – Surface Analysis – Point data to Surface: Various methods of interpolation-DEM: View shed Analysis

UNIT V DATA OUTPUT AND WEB BASED GIS

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Familiarize with concepts of choosing map projections, 2D transformation
- Understand the data models and data structures used for spatial data
- Perform geospatial analysis and network analysis
- To understand the web based GIS architecture and concepts of Map server

REFERENCES:

RS8111 REMOTE SENSING AND PHOTOGRAMMETRY LABORATORY

OBJECTIVE:
- To provide exposure in handling equipment like stereoscope, parallax bar, analog stereo plotter, analytical stereo plotter and semi analytical stereo plotter.

PHOTOGRAMMETRY EXERCISES
1. Testing stereovision with test card
2. Mirror stereoscope- base lining and orientation of aerial photographs.
3. Use of parallax bar to find the height of point.
4. Orientations in analogue stereo plotter
5. Orientation and mapping in semi analytical stereo plotter.
6. Orientations using digital photogrammetric workstation.

REMOTE SENSING EXERCISES
1. Spectral reflectance observation of the following using spectro radiometer.
   i) Vegetation. ii) Soil iii) Water

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Director
2. Map reading of Survey of India topo sheets.
   Visual interpretation of different satellite data and aerial photographs for the preparation of
   following;
3. Land use/land cover map.
4. Geology and geomorphology maps.
5. Slope maps.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to

- Understand the concept of stereoscopy and its use to determine height by parallax
  measurements
- Perform orientations using analogue, semi-analytical and digital photogrammetric workstations
- To obtain spectral signature of various objects using spectroradiometer
- To visually interpret satellite imagery for generation of various thematic maps

RS8162  
GIS AND DIGITAL CARTOGRAPHY LABORATORY  

OBJECTIVES:

- The exercises are designed to give practical exposure to the students to data input, data
  storage, data analyses and data output capabilities of a standard GIS software.
- It also adds skills in mapping techniques and map outputs.
  1. Spatial Referencing and Rectification of Scanned Map 3
  2. Database Creation and Onscreen Digitization 3
  3. Projection and Reprojection of spatial data. Data Conversion – V
     Vector to Raster, Raster to Vector 3
  4. Adding attribute data – querying on attribute data 3
  5. Generation of DEM: from contours, spot heights, GRID and TIN,
     Isometric mapping 6
  6. Vector Analysis – Buffering, Overlay and Network analysis,
     flood mapping 6
  7. Raster Analysis – Measurement - Arithmetic overlaying,
     Logical overlaying, Class interval selection, choropleth maps 6
  8. Map Output - Bar charts, and located symbols 3
  9. Map compilation 3
  10. Modelling spatial variability 3
  11. Weighted theissen polygon and districting 3
  12. Customization and scripting 3

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to

- Perform the georeferencing and rectification of geospatial database
- Project and reproject using different map projections
- Perform raster and vector analysis on geospatial data
- Gain skills in scripting for customization of GIS
OBJECTIVE:
- The objective of the course is to describe about the procedure of satellite data acquisition and analysis.

UNIT I FUNDAMENTALS

UNIT II SENSOR AND DATA MODEL

UNIT III IMAGE ENHANCEMENTS
Spectral signatures – Image characteristics, feature space scatterogram- point, local and regional operation – contrast, spatial feature and multi image manipulation techniques - Fourier transform - principle component analysis - Optimal Rotation Transformation – scale-space transform, wavelet transform.

UNIT IV INFORMATION EXTRACTION
Image registration and ortho rectification – resampling - multi-image fusion - Baye’s Theorem – parametric Classification and training sites - Supervised, Unsupervised and Hybrid classifiers – other Non - parametric classifiers - sub-pixel and super-pixel classification – Hyper-spectral image analysis – Accuracy assessment.

UNIT V IMAGE ANALYSIS
Pattern recognition - boundary detection and representation - textural and contextual analysis - decision concepts: Fuzzy sets - evidential reasoning - Expert system - Artificial Neural Network.

OUTCOME:
On completion of this course, the student shall be able to
- Get familiarized about various image enhancement and image processing techniques

REFERENCES:
UNIT I  PASSIVE SURVEY SYSTEM  9  

UNIT II  ACTIVE SURVEY SYSTEM  9  

UNIT III PLATFORMS, SENSORS AND DATA PROCESSING,  9  
Airborne, Space borne and Indian missions, Data products and selection procedure, SAR Image Processing software - Measurement and discrimination - Backscatter Extraction - Preprocessing and speckle filtering - Image Interpretation, SAR Image Fusion.

UNIT IV APPLICATIONS  9  
Applications in Agriculture, Forestry, Geology, Hydrology, cryospace studies, landuse mapping and ocean related studies, military and surveillance applications, search and rescue operations, ground and air target detection and tracking - case studies.

UNIT V IMAGING AND NON IMAGING METRICS  9  

TOTAL: 45 PERIODS

OUTCOMES:  
On completion of this course, the student shall be able to  
• Understand concepts of passive and active microwave system  
• Gain knowledge in the principles of Microwave image analysis and interpretation  
• Understand the various application domains of microwave satellite data  
• Gain exposure to Interferrometry and Polarimetry concepts

REFERENCES:  
OBJECTIVE:
- To make the post graduate students understand principles, processes and applications of thermal and hyper spectral remote sensing for earth resources.

UNIT I  FUNDAMENTALS OF THERMAL REMOTE SENSING
- Radiation science basics - Thermal radiation principles, thermal interaction behavior of terrain elements, thermal sensors and specifications – MUST (Medium Scale Surface Temperature Missions) infrared sensors and radiometers - aerial thermal images - Image characters, spatial and radiometry-sources of image degradation –radiometric and geometric errors and correction – interpretation of thermal image

UNIT II THERMAL IMAGE AND INTERPRETATION

UNIT III FIELD AND IMAGE SPECTROMETRY

UNIT IV HYPERSPECTRAL IMAGE ANALYSIS

UNIT V HYPERSPECTRAL IMAGE APPLICATIONS
- Application to lithology, mineral exploration – agricultural crop systems – stress detection, plant production, vegetal bio physics and bio chemistry, soil moisture, soil characteristics, degradation status - forestry canopy characters, ecosystem, forest health, biodiversity, Gap dynamics, environmental and resource management.

TOTAL 45 PERIODS

OUTCOMES:
- On completion of this course, the student shall be able to
  - Understand the principles and properties of Hyperspectral and Thermal Remote Sensing.
  - Acquire skills in analysing Thermal and Hyperspectral Remote Sensing data for various thematic mapping and its applications.

REFERENCES:

RS8211       DIGITAL IMAGE PROCESSING LABORATORY

OBJECTIVE:
- This course will facilitate the students to have hands on experience on different steps of satellite image processing using various softwares.
1. Reading and Displaying satellite data from BIL, BSQ and BIP Formats
2. Generating False Colour Composite (FCC)
3. Extracting area of Interest (AOI)
4. Generating Histogram of various bands
5. Georeferencing the base image
6. Geometric correction of satellite image
7. Enhancement using Band ratio and NDVI
8. Enhancement using different Filtering techniques
9. Enhancement using Image Fusion
10. Principal Component Analysis (PCA)
11. Fourier analysis
12. Unsupervised Classification
13. Supervised Classification
14. Classification using Neural Network and Fuzzy Logic
15. Accuracy Assessment and Change detection study

TOTAL: 45 PERIODS

OUTCOME:
On completion of this course, the student shall be able to
- Acquire skills to carry out the Lab Exercises independently on various Visual and digital Image processing techniques.

RS8212       MICROWAVE REMOTE SENSING LABORATORY

OBJECTIVE:
- To provide the exposure for the students with hands on experience into the Microwave Image Processing Using softwares
1. Reading, displaying and header extraction of SAR images and to Generate Multilook Images.
2. Geocoding with Dem and without DEM
3. Speckle Filtering Techniques and Backscatter extraction
4. Visual Image Interpretation and SAR Image fusion with Optical data
5. Scattering Matrix and Scattering properties retrieval
6. Polarimetric Classification
7. Interferometric processing-Base line estimation and Registration
8. Interferogram Generation and Phase values extraction

3  6  6  3
9. Phase unwrapping and Interferogram Interpretation. 3
10. Altimetry Processing- To import and display from Netcdf format 3
11. Correction methodologies and Sea surface height calculation 3
12. Scatterometry- reading and displaying the backscatter values 3
13. Retrieval of Wind parameters from backscatter values. 3

TOTAL = 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to

- Geocode the SAR images and to perform Filtering
- Analyse the polarimetry and interferometry microwave data
- Phase Unwrap the image for interpretation
- Process the scatterometer and altimeter data

RS8301 SCRIPTING AND CUSTOMIZATION L T P C
2 0 2 3

OBJECTIVE:
- Scripting is fundamental for providing services using GIS technology. The course provides skills in learning a set of scripts and their applications.

UNIT I FUNDAMENTALS 6+6
Customisation of GIS – Definition – Need – Advantages – Scripting Languages used for Customisation – Automated tools available for Customisation – Linking external Models: Loose Coupling, Tight Coupling and Embedded Coupling

UNIT II ARC GIS MODEL BUILDER 6+6
Model Builder – Model elements: Tools, Variables, Connectors - Setting up Models – Executing Model – Model Validation – Model builder to create Tools – Advance techniques in Model Builder – Geoprocessing Techniques in Model Builder

UNIT III PYTHON PROGRAMMING 6+6
Introduction to Python – built- in data types and control flow - Modules and packages - Concepts – iterators, generators, decorators, and meta-classes - String manipulation, Regular Expressions, input and output, file management – Geoprocessing Python Scripts: Intersection, Union and Buffering

UNIT IV .NET FRAMEWORK FOR SERVICE INTEGRATION 6+6
Concept of .NET framework – Common Language Infrastructure(CLI): execution, including functions for exception handling, garbage collection, security, and interoperability – Base Class Library(BCL) and Framework Class Library(FCL) – Customisation using .NET

UNIT V WEB GIS CUSTOMISATION 6+6
Web GIS – Web Server, Map Server and Data Server – Scripting for serving maps, map editing and geoprocessing functionalities – Open Source Map Server Customisation

TOTAL = 30 + 30 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to

- Familiarize with various methods of coupling external models with GIS
- Implement small scale GIS models with Model Builder
- Write scripts for small scale spatial functionalities with Python and .NET framework
- Write scripts for web services using Open Source Map Server
REFERENCES:
3. Manuals of Map server and Geo server

OBJECTIVE:
- Utility design is an important component for providing services to the population. The skills in handling health, routing, power management, crime and accident mapping are necessary for providing manageable utility. The course prepares the students with mapping modelling skills of utility management. Mobile devices are part of Geospatial technology and the student is expected to equip in implementing mobile GIS.

UNIT I HEALTH APPLICATIONS
Health Infrastructure Mapping Studies – Disease Mapping: Spatio-temporal visualization of disease pattern and trends – Geostatistical Analysis for Health studies - Epidemiological Studies – Spatial analysis of Vector borne Diseases

UNIT II CRIME MAPPING AND ACCIDENTS

UNIT III ROUTING OF UTILITIES

UNIT IV POWER, TELECOMMUNICATION AND ASSET MANAGEMENT STUDIES
Power distribution and outage management - Signal Strength Mapping and line of sight analysis - mobile tower for planning, signal strength coverage mapping – Asset Management of Power /Electric, Telecommunication Utilities – asset management in PWD.

UNIT V MOBILE GIS
Mobile Devices – Mobile GIS software and services – Geospatial Data format and Storage- Location Based Services using Mobile devices – Open Source Mobile GIS software-Geospatial web services for mobile GIS – Case Studies

TOTAL = 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Perform geostatistical analysis of demographic data for various health, crime and accident management applications
- Understand the least cost path analysis for routing of utilities
- Acquire skills in asset management of utilities
- Familiarise with Location Based Services using Mobile Devices
REFERENCES:

OBJECTIVE:
• The content of this course enable the students to understand the application potentialities of remote sensing data separately and in combination with GIS techniques for Agriculture and Forestry.

UNIT I CROPS ACREAGE AND YIELD ESTIMATION
Spectral properties of crops in optical & TIR region, Microwave backscattering behavior of crop canopy – crops identification and crop inventory – crop acreage estimation – vegetation indices and biophysical model – Yield modeling – crop condition assessment – command area monitoring and management – Microwave RS for crop inventory – Case studies

UNIT II SOIL MAPPING

UNIT III DAMAGE ASSESSMENT

UNIT IV FORESTRY

UNIT V CLIMATIC IMPACT OF AGRICULTURE AND FORESTRY

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
• Understand the concepts involved in mapping of crop acreage and yield estimation
• Understand the principles space based input for crop damage assessment
• Gain skills in various applications of Forestry and sustainable watershed management
REFERENCES:

RS8003 REMOTE SENSING APPLICATIONS FOR EARTH SCIENCES L T P C 3 0 0 3

OBJECTIVE:
• The objective of the course is to impart knowledge about the various geological structures and Geomorphic Landforms. The students will be exposed to various Remote Sensing Applications to earth Sciences.

UNIT I LITHOLOGY AND STRUCTURE 9

UNIT II SPECTRA OF ROCKS AND MINERALS 9
Spectral properties - Elemental composition and spectra of rocks and minerals – physical properties and spectra - Optimal spectral windows – Geologic Remote sensing and mapping.

UNIT III GEOMORPHOLOGY 9

UNIT IV SUB-SURFACE EXPLORATIONS 9
Types of Geophysical Surveys - Electrical resistively surveys - aeromagnetic surveys - Electromagnetic surveys - Seismic surveys and GPRS - Planning Geophysical surveys - Geophysical surveys in resource mapping and monitoring.

UNIT V REMOTE SENSING AND GIS APPLICATIONS 9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
• Understand mapping lithological and structural features
• Understand the concepts involved in Geomorphic Mapping
• Understand the geophysical / geomagnetic surveys for subsurface exploration
• Get exposed to various earth sciences applications

REFERENCES:
4. Parbin Singh ‘Engineering and General Geology’ Ketson Publication House 1987
10. Clark J. Handbook for coastal zone Management NY and London Lewis Publishers Kenchington R et.al. (Eds)
11. Nancy Hoalst-Pullen, Mark W. Patterson; Geospatial Technologies in Environmental Management (Geotechnologies and the Environment), 2010, Springer
12. A. Ganesh; Applications of Geospatial Technology, 2006

RS8004 REMOTE SENSING APPLICATIONS FOR ENVIRONMENTAL IMPACT ASSESSMENT (EIA) & RISK ASSESSMENT 3 0 0 3

OBJECTIVE:
- To understand the various remote sensing and GIS technological applications in Environmental Impact Assessment and Risk Assessment

UNIT I INTRODUCTION 9

UNIT II COMPONENTS AND METHODS FOR EIA 9

UNIT III EIA MANAGEMENT 9

UNIT IV TOOLS AND METHODS FOR RISK ASSESSMENT 9
UNIT V    RISK MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Understand the concepts of Environmental Impact Assessment
- Understand the principles involved in EIA management
- Get exposed to various methods of risk assessment and management

REFERENCES:

RS8005     REMOTE SENSING APPLICATIONS FOR OCEAN ENGINEERING AND COASTAL ZONE MANAGEMENT

L T P C
3 0 0 3

OBJECTIVE:
- This Course deals with the fundamental of physical, chemical and Biological oceanography and the various RS applications to coastal zone management.

UNIT I    OCEAN ENGINEERING

UNIT II  OCEAN GENERAL STUDIES

UNIT III  COASTAL ENGINEERING

UNIT IV  OCEANOGRAPHIC APPLICATIONS
Use of Microwave data – CZCS studies – chlorophyll production index – various sensors used for coastal application – physical oceanographic parameter estimation – sea surface temperature.
UNIT V  COASTAL ZONE APPLICATIONS  9
TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Get exposed to the basics of Ocean and Coastal Engineering
- Acquire knowledge about various satellites and sensors in the domain of Ocean and Coastal applications.

REFERENCES:

OBJECTIVE:
- Promoting open source software is basic for research and providing cost effective solutions. The students equip with concepts and uses of Open source GIS facilities.

UNIT I  FUNDAMENTALS  9
Concepts of free and proprietary software – free, shareware and open source software - Levels of open source licensing - Role of open source software in remote sensing and GIS implementation - OGC, OSGeo and GDAL oraganisations - Open Source Standards - FOSS and FOSS4G

UNIT II  GENERAL ARCHITECTURE  9
Development environment: C and Java - C family , software and software tools - Java , portability and Web - Interoperability - Concepts of Desktop systems, Servers, Map Server, Database Services and Web Services – Integrated GIS and Domain specific software

UNIT III  DATABASE ENGINES AND GIS  9
Open Source Database Engines (MySQL, SQLite Oracle and PostgreSQL) - Spatial referencing (Oracle Spatial, Spatialite and PostGIS) - Server and clients - Server setup and administration (PgAdmin) – server managing and monitoring - SQL in Queries, Views and Triggers.

UNIT IV  GEOSPATIAL SERVER, WEB SERVICES AND SCRIPTING  9
Concepts of WMS, WCS, WFS and WPS - Sensors standards - GeoSpatial services and GeoWeb - Integration of Data, base map and analysis functions - Image and map rendering and web services - scripts in GIS data and WEB applications (PHP, Perl, Python, Java and Ajax)
UNIT V OPEN SOURCE SOFTWARE AND SERVICES
OS Remote Sensing software (Eg: ILWIS, OSSIM, ORFEO, OpenEV) - Desktop systems (Grass, gvSIG, QGIS and SAGA) - Map Servers and Web Services (GeoServer and Map Server) - Embedded scripts for GIS services (HTML with PHP and Python) - Geo Statistical operations and Open Statistical tools - R environment and R spatial - standards in GIS documents.

TOTAL = 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Understand the important of Open source technology in GIS and various options available in its implementation.
- Acquire skills in using open source software along with the principles of handling licenses and source code modification.

REFERENCE:

RS8072 REMOTE SENSING APPLICATIONS FOR DISASTER MITIGATION AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
- To teach about the various principles involved and also the various mitigation to be adopted during the disasters.

UNIT I DISASTER PRINCIPLES
Concepts and principles – Hydrological, climatological and geological disasters, characteristics crisis and consequences – Role of government administration, University research organization and NGOs - International disaster assistance – Sharing technology and technical expertise

UNIT II LONG TERM MITIGATION MEASURES

UNIT III SAFETY RATING OF STRUCTURES

UNIT IV SPACE SCIENCE INPUT IN DISASTER MANAGEMENT

UNIT V EMERGENCY PLANNING USING SPATIAL AND NON-SPATIAL DATA
Information system management: Spatial and non-spatial data bank creation - Operational emergency management – Vulnerability analysis of infrastructures, settlements and population – Pre-disaster and post disaster planning for relief operations – Potential of GIS application in disaster mapping – Disaster management plan – Case studies.

TOTAL: 45 PERIODS
OUTCOMES:
On completion of this course, the student shall be able to
- Understand the fundamentals and measurements of disaster management
- Gain knowledge in concepts of long term mitigation measures
- Gain exposure to various space based input for disaster management
- Understand the use of spatial data for emergency planning

REFERENCES:

OBJECTIVE:
- To impart knowledge in Concepts in Meteorology, Radio and Satellite Meteorology and its Applications

UNIT I  GENERAL CONCEPTS IN METEOROLOGY  9

UNIT II  RADIO METEOROLOGY  9

UNIT III  SATELLITE METEOROLOGY  9
UNIT IV  METEOROLOGICAL APPLICATIONS


UNIT V  GLOBAL METEOROLOGICAL APPLICATIONS

Global and subglobal events – tracking of large weather system – Cloud motion vector – Dvorak’s techniques of Cyclone Intensity estimation - T-phi and other climatic charts - T number and current intensity No. – Applications to storm surge estimation - Satellite soundings – Global Warming – Sealevel changes and Consequences.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

• Understand the concepts of Meteorology and various application areas of Meteorology.
• Gain knowledge on Radio and Satellite meteorology
• Acquire knowledge about various climatic charts

REFERENCES:


OBJECTIVE:

This subject deals with the basics of hydrology and also various remote sensing and GIS applications in the field of hydrology and water resources.

UNIT I  FUNDAMENTALS OF HYDROLOGY

UNIT II  DRAINAGE BASIN ASSESSMENT 9

UNIT III  IRRIGATION AND WATER QUALITY 9
Project investigation – implementation - maintenance stage - location of storage / diversion works – canal alignment – depth - area capacity curve generation - water quality parameters – physical, chemical, biological properties - water quality mapping and monitoring – correlation model for pollution detection and suspended sediment concentration– case studies.

UNIT IV  GROUND WATER 9

UNIT V  WATERSHED MANAGEMENT 9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course students shall be able to
• Understand the assessment of Basin and its hydrology using Geospatial technology.
• Get exposure to the Groundwater and Watershed Management aspects of GIS

REFERENCES:
2. Dr. David Maidment, Dr. Dean Djokic, Hydrologic and Hydraulic Modeling Support with Geographic Information Systems, Esri Press 2000,
6. Hoalst-Pullen, Nancy; Patterson, Mark W; Geospatial Technologies in Environmental Management, 2010, Springer.

RS8075  REMOTESENSING TECHNOLOGY FOR URBAN AND REGIONALPLANNING

OBJECTIVES:
• To introduce the concepts of urban and regional planning
• To explore the use of the geospatial technology in advanced analysis in planning.
UNIT I  FUNDAMENTALS  9
Concepts of Urbanization and Urban Areas - concept of regions - formal and functional regions -
census classification of urban areas - Planning Goals: Natural Resources Management; socio-
economic management and infrastructure planning - Planning physical structures and functional
domains - data and information for urban and regional planning by Remote Sensing - Planning goals
for urban areas and regions.

UNIT II  INVENTORY AND MAPPING  9
Digital and image records of the Urban areas and Regions – classification of settlement patterns and
structures – Segmentation of Built-up areas – Classification algorithms – Inventory of resources and
measurements - Land use/ Land cover mapping – Deduction of sprawl, renewal and morphological
changes – resolution of RS data in feature extraction and object delineation - mapping resources,
developments and demography by choropleth and isopleth techniques - high resolution remote
sensing data in urban analysis..

UNIT III  ASSESSMENT OF POTENTIALS  9
Urban morphology – Housing typology – Population estimation from remote sensing – Infrastructure
demand analysis – Land suitability analysis for Urban renewal – Plan formulation for sectoral and
regional, development – Use of remote sensing and GIS in assessment, estimation and projections -
Design of Urban and regional information systems – revenue and tax collection GIS - planning
facilities and amenities..

UNIT IV  LOCATION-ALLOCATION AND TRANSPORTATION PLANNING  9
Site specific GIS: Housing development, parks and social facilities planning – urban and regional
transportation corridors - wholesale and retail trade interactions - commuting-Classification of traffic –
Optimum route and plans / shortest path – Alignment planning – Traffic and flow management –
Accident analysis – case studies.

UNIT V  MODELLING Techniques  9
Urban growth modeling – GIS modelling - local and regional interaction potential- Expert systems in
AM/FM planning – 3D city models – digital terrain of the urban areas and regions- DEM and socio-
economic – Land use Transportation interaction models – Intelligent transportation systems –Risk,
vulnerability models in crime, accidents and disasters - case studies  

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course students shall be able to
- Gain knowledge of urban and regional planning concepts, the use of geomatics technology in
  planning and management in urban areas and regions.
- Familiarize with case studies, inputs from Remote Sensing and GIS
- Get exposure in modelling in urban land use and its forecasting.

REFERENCES:
4. Michael F. Goodchild, Louis T. Steyaert, Bradley O. Parks, Carol Johnston, David Maidment,
   Michael Crane, Sandi Glendinning, GIS and Environmental Modeling: Progress and Research
   Issues (Hardcover) by, Publisher: Wiley; 1st edition, 1996.
5. Roland Fletcher, The Limits of Settlement Growth: A Theoretical Outline (New Studies in
6. Said Easa, Yupo Chan, “Urban Planning and Development Applications of GIS”, Amer Society of
   Civil Engineers, 1999, ISBN: 978-0784404614

GM8071 AIRBORNE LASER TERRAIN MAPPER (ALTM) L T P C 3 0 0 3

OBJECTIVE:
- To provide exposure to LiDAR mapping and its applications

UNIT I LASER AND SPACE BORNE LASER PROFILERS 9

UNIT II AIR BORNE LASER SCANNERS 9

UNIT III LIDAR DATA PROCESSING 9

UNIT IV LIDAR DATA MANAGEMENT AND APPLICATIONS 9

UNIT V TERRESTRIAL AND BATHYMETRIC LASER SCANNER 9
Terrestrial Lidar: Static and Mobile (Vehicle Mounted) LiDAR -Terrestrial LASER Scanner Specification – Applications of Terrestrial LASER Scanning –Bathymetric LASER Scanner – Specification – Depth of Penetration: Secchi Depth – Applications of Bathymetric LASER Scanner

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Understand the components of Airborne Laser Scanning System
- Plan for Airborne Laser Scanning data Acquisition
- Understand the concepts for generating DEM from Digital Surface Model by filtering
- Get exposed to various domain applications of Airborne Laser Scanner data
REFERENCES:

GM8072 GEOMATICS IN ENVIRONMENTAL ENGINEERING L T P C 3 0 0 3

OBJECTIVE:
• To understand the various remote sensing and GIS technological applications in the field of Environmental Engineering.

UNIT I SATELLITE FOR ENVIRONMENTAL MANAGEMENT 9

UNIT II WATER QUALITY MANAGEMENT 9

UNIT III AIR QUALITY AND NOISE MANAGEMENT 9

UNIT IV SOLID WASTE MANAGEMENT 9

UNIT V GLOBAL PROSPECTIVE 9
Prevention and Control measures – Carbon footprints and sinks, carbon trading, carbon credits and marketing, Indian and international status - case studies.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
• Acquire knowledge of various components of environment and assessment of their quality
• Gain exposure to current and future satellite missions used for environmental assessment and modeling
REFERENCES:

GM8073 OBJECT ORIENTED INFORMATION SYSTEM

OBJECTIVE:
- This course will facilitate the student to understand the concept of object oriented programming, software reuse, different object oriented methodologies and object oriented systems. This course will help the student to develop software in C++.

UNIT I PRINCIPLES OF OOP
Motivation for OOP-Objects and Classes, Abstraction and Encapsulation, Message passing, Inheritance, Overriding, Multiple inheritance, Dynamic Binding, Virtual Methods, polymorphism, Abstract classes, Virtual classes, Dynamic binding mechanisms in Smalltalk and C++, object oriented notations.

UNIT II PROGRAMMING IN C++
Introduction to C++ - Keywords, Identifiers-Variables-operators-Manipulators-Classes and Object -Member Functions-Private and Public Member function –Nesting of Member Functions – Array of objects- pointer to members –Constructors-Destructors-Type conversions-Exercises.

UNIT III INHERITANCE AND WORKING WITH FILES IN C++

UNIT IV OBJECT ORIENTED ANALYSIS AND DESIGN
CRC method for defining classes, inter class relationships – introduction to object oriented software engineering, use case analysis, object diagrams, dynamic models – object interaction diagrams and state diagrams, functional models, from analysis to design to relevant topics from various methodologies such as Jacobson, Rum Baugh, Booch and unified methodology. Elements of design reuse – object oriented patterns.

UNIT V DATABASE MANAGEMENT SYSTEM

TOTAL: 45 PERIODS
OUTCOMES:
On completion of this course students shall be able to
- Acquire skills in Object Oriented Programming and Problem Solving
- Gain knowledge in C++ Programming Language and Data Base Management System

REFERENCES:
5. Mike O.Docherty, Object oriented analysis and design, John Wiley and sons, 2005.

GM8251 DECISION SUPPORT SYSTEM

OBJECTIVE:
- To impart the knowledge of Expert Systems, Fuzzy logic and concepts of Object oriented programming for Geomatics and its Applications.

UNIT I  FUNDAMENTALS

UNIT II  KNOWLEDGE ACQUISITION

UNIT III  RULE BASED EXPERT SYSTEMS

UNIT IV  INEXACT REASONING

UNIT V  OBJECT BASED EXPERT SYSTEM
Concepts of Object Oriented programming - Overview, anatomy of class, sub class, instance, properties, inheritance, encapsulation, rules interaction with object, design methodology for frame based system – domain, classes, instances, rule – communications, design interface – C++ Programming – case studies in Geomatics.

TOTAL: 45 PERIODS
OUTCOMES:
On completion of this course, the student shall be able to

- Understand the concepts of knowledge acquisition, storage and analysis
- Understand rule based and frame based expert system
- Use fuzzy logic concepts for artificial intelligence and decision support
- Use object based concepts for decision support system

REFERENCES: