

M. Sc - GEOSPATIAL SCIENCE & TECHNOLOGY
COURSE STRUCTURE
I YEAR

I-SEMESTER

SUBJECT CODE	SUBJECT TITLE	L	P	CREDITS
GST 1.1	Introduction To Geospatial Science & Technology	4	0	4
GST 1.2	Computer Basics and Programming	4	0	4
GST 1.3	Surveying Technology	4	0	4
GST 1.4	Elements of Photogrammetry	4	0	4
GST 1.5	Remote Sensing	4	0	4
GSTL 1.6	Surveying & Thematic Mapping Lab	-	8	8
GSTL 1.7	Computer Laboratory – C , C++	-	8	8
	Total Credits (5 Theory + 2 Lab)			36

II -SEMESTER

SUBJECT CODE	SUBJECT TITLE	L	P	CREDITS
GST 2.1	Microwave and Hyper spectral remote sensing	4	0	4
GST 2.2	Experimental Statistics	4	0	4
GST 2.3	Geodesy and GPS	4	0	4
GST 2.4	Digital Image Processing	4	0	4
GST 2.5	Geographical Information Systems	4	0	4
GSTL 2.6	Digital Image Processing Lab	-	8	8
GSTL 2.7	Field Spectroscopy Lab	-	8	8
	Total Credits (5 Theory + 2 Lab)			36

II YEAR**III -SEMESTER**

SUBJECT CODE	SUBJECT TITLE	L	P	CREDITS
GST 3.1	Digital Photogrammetry	4	0	4
GST 3.2	Spatial Data Analysis & Modeling.	4	0	4
GST 3.3	Data Base Management Systems (DBMS)	4	0	4
EST 3.4	Environmental Impact Assessment	4	0	4
GST 3.5	GST For Natural Resources Management	4	0	4
GSTL 3.6	Digital Photogrammetry Lab	-	8	8
GSTL 3.7	GIS & GPS Lab	-	8	8
	Total Credits (5 Theory + 2 Lab)			36

IV SEMESTER

SUBJECT CODE.	SUBJECT TITLE	L	P	CREDITS
GSTP 4.1	Project Work	-	-	36
	Total Credits			36

L- No. of Lectures per week; P- No. of Practical's per week.

GST-1.1 INTRODUCTION TO GEOSPATIAL SCIENCE & TECHNOLOGY

UNIT 1 INTRODUCTION:

Geospatial data, Spatial data infrastructure, three important geospatial technologies, Spatial elements.

UNIT II COORDINATES & COORDINATE SYSTEMS:

Coordinates and coordinate systems, Datums and geodetic systems, Coordinate transformations Basic electromagnetic radiation.

UNIT III DATUMS & GEODETIC SYSTEMS:

Geodetic datums, Geodetic reference system, Applications

UNIT IV GLOBAL POSITIONING SYSTEMS:

Introducing the Global Positioning System, Fundamentals of GPS signals and data, GPS mathematical models, GPS projects : some planning issues.

UNIT V PHOTOGRAMMETRY & REMOTE SENSING:

Definition and Scope, History of Photogrammetry and Remote Sensing, Principle, remote Sensing data acquisition, Remote Sensing data analysis methods, Advantages and Limitations, Hardware and Software required.

UNIT VI GEOGRAPHIC INFORMATION SYSTEMS(GIS):

Geographic Information Systems (GIS) and science, Fundamentals of Geographic Information Systems, Geographic data structures, Processing of spatial data

Unit VII GIS DATA ANALYTICAL METHODS:

Spatial data and modeling, TIN, DTM, Overlay, Spatial Measurement etc.,

UNIT VIII OVERVIEW OF GST APPLICATIONS:

GST for Environmental, Social, Local Government and Commercial applications.

Books:

1. Manual of Geospatial Science & Technology edited by John D. Bossler (Taylor & Francis).
2. Textbook of Remote Sensing and Geographical Information Systems M. Anji Reddy, BS Publication.
3. Fundamentals of GIS by MICHAEL N DEMERS. Published By john Wiley & Sons Inc.
4. Environmental Modeling with GIS, Michael F. Goodchild, Bradley O. Parks, Louis T. Stewart
5. Geographic Information Systems: A Management Perspective by Stan Arnoff.

GST-1.2 COMPUTER BASICS AND PROGRAMMING

UNIT I :

Computer Basics, Computer Capabilities, Types of computers, Application areas, functional block diagram, central processing unit, functions of ALU and control unit in CPU, Address word, RAM, ROM Cache memory, Associate memory, Magnetic disc, tape, floppy, optical disc, address bus, data bus, Functions of I-O devices, key board, Mouse, light pen, printers, monitors

UNIT II :

Binary number System, Binary Arithmetic, Computer Architecture, Operating System, types of operating systems, Computer generation, Classification

UNIT III :

Machine Language, Assembly language, High Level Language, Compiler, Assembler, networks, LAN, WAN, MAN, Internet, Computer Graphics : Graphics applications-display devices- displaying method-storage format for pictures-image acquisition and storage-Multimedia: capturing of moving image-compression of video data-acquiring and storing Audio signals.

UNIT IV :

Algorithm, Flowchart, Program development steps, Basic Structures of C language, C tokens, Data types, declaration of variables, assigning values, arithmetic, relational and logical operator, increment and decrement operators, control operator, bit-wise operator, expressions, evaluation, input-output operators.

UNIT V:

IF and SWITCH statement, WHILE, DO-WHILE and FOR statements, C: Programs covering all the above aspects.

UNIT VI :

One dimensional and Two dimensional arrays, initialization, string variables, declaration, reading, writing, string handle functions, functions: Function declaration and definition-argument passing- call by value-call by reference-user-defined functions, variables & storage classes, example C Programs.

UNIT VII :

Structure definition, initializing , assigning values, passing of structures as arguments, unions, declaring & initializing of pointers, pointer based expressions, arrays, strings.

UNIT VIII :

Functions and structures, C program examples, file management in C, opening & closing, I-O operations files.

Text Books:

1. Programming in ANCI C - E. Balaguru Swamy
2. Fundamentals of Computers - V.Rajaraman

GST-1.3 SURVEYING TECHNOLOGY

UNIT I:

Introduction, datum and Reference System, horizontal data and Vertical data, Survey operations, Field work, Office work

UNIT II:

Classification of Surveys: Geodetic surveys, Plain surveys and Shape of earth, Classification of plain surveys, Topographical surveys, Photogrammetric surveys, Engineering surveys, Hydrographic surveys, Mine surveys, Cadastral surveys.

UNIT III:

Principles and Methods of Surveys: working from whole to part, Economy of Accuracy, Consistency of accuracy, Independent checks, Direct methods of locating point C with respect to given points A and B.

UNIT IV:

Stages in Surveying, Control Survey, Planimetry and Height control by triangulation and Traverse, Height control by Spirit leveling, Detail survey by Plane Tabling methods, Contour survey and Depiction of heights.

UNIT V:

Detail survey by conventional methods: Methodology, Survey and depiction of details by plane tabling methods, contour survey, depiction of heights, Completion of Sections,

UNIT VI:

Surveying by other methods, Revision Survey, Blue print survey, Verification survey, Colour print survey

UNIT VII:

Office work: Pre field office work and post field office work, Map Design, Symbology, Colour combination, Visual balancing and final printing of maps.

UNIT VIII:

Modern trends in surveying and mapping: Global Positioning System (GPS) for ground control and extension, Total Station System for detail surveying. Digital Photogrammetry, Remote Sensing, Digital Cartography, Geographical Information System.

Books:

1. Surveying and Mapping Volume I and II by David Clarke by Mc. Graw Hill
2. Geoinformatics for Environmental Management by M. Anji Reddy, BS Publications
3. Elementary Surveying: An introduction to Geomatics, 12th edition(Amazon).

GST-1.4 ELEMENTS OF PHOTOGRAMMETRY

UNIT I INTRODUCTION:

Definition of photogrammetry, History of photogrammetry, Types of photographs, Organisation of Aerial photography, Geometry of vertical photograph, Scale of vertical aerial photograph, Displacement of image position due to height, Displacement of image position due to tilt.

UNIT II AERIAL CAMERAS:

Introduction, Types of aerial cameras, Classification single lens frame camera, Components of frame aerial camera, Fiducial marks, Principle point, Camera mounts, Camera controls, Automatic data recording, Camera calibration, Elements of interior orientation.

UNIT III STEREO PHOTOGRAMMETRY:

Depth perception, Monoscopic depth perception, stereoscopic depth perception, Experiment for stereoscopic viewing, Stereoscopic viewing of overlapping aerial photographs, Stereoscope, pocket stereoscope, Mirror stereoscope, Procedure for use of stereoscopes, Steps for viewing stereo pair of aerial photographs, Y parallax, Vertical exaggeration in stereo viewing.

UNIT IV STEREOSCOPIC PARALLAX:

Definition of parallax, stereoscopic parallax, Methods of parallax measurement (monoscopic), Principle of floating mark, Stereoscopic methods of parallax measurement, parallax equations, Elevation by parallax differences, Approximate equation for elevation, Measurement of parallax differences, Parallax corrections, Parallax correction graph, Computation of flight height and air base, Error evaluation.

UNIT V FLIGHT PLANNING:

Need for flight planning, Items for flight planning, Purpose of photography, Photo scale, Flying height, End lap and side lap, Base-height (B-H) ratio, Neat model, Flight map, Flight planning template.

UNIT VI CONTROL FOR AERIAL PHOTOGRAPHY:

Definition, Classification (Horizontal,Vertical), Nature and characteristics of control points, Location and numbering, Bridging of strip, Bridging of blocks, Ground control provision, Post-pointing and pre-pointing.

UNIT VII ORIENTATION PROCEDURES FOR STEREO PLOTTING INSTRUMENTS:

Introduction, Basic concept, Interior orientation, Relative orientation, Absolute orientation.

UNIT VIII AERIAL TRIANGULATION:

Introduction, Purpose of aerial triangulation, Principle of Aerial Triangulation, Classification of Aerial triangulation based on methods, Preparation for aerial triangulation, Independent Model Triangulation (IMT), Aerial Triangulation (Analytical method), Blocks of photos, Bundles adjustment.

Books:

1. Paul, R. Wolf Elements of Phogrammetry, McGrew-Hill, International Book Company, Japan, 1993.
2. Geoinformatics for Environmental Management by M. Anji Reddy, BS Publications
3. Remote sensing and image interpretation by Lillesand and Kiefer, John wiley and sons.
4. Elements of Photogrammetry by K.K.Rampal.

GST-1.5 REMOTE SENSING

UNIT I INTRODUCTION:

Definition, History of Remote Sensing. Basic components of Remote sensing, Electromagnetic Remote sensing process, Passive and active remote sensing.

UNIT II PHYSICS OF REMOTE SENSING:

Electromagnetic Spectrum, Energy source and its characteristics, Nature of EMR, laws governing energy interactions, Blackbody radiation principles, radiation quantities and terminology

UNIT III EMR ENERGY INTERACTION WITH GROUND:

EMR Interaction With Earth Surface Materials -Spectral signature concepts – Spectral reflectance & emittance – Typical spectral reflective characteristics of water – vegetation, soil, minerals/rock, man-made structures

UNIT IV ATMOSPHERIC INTERACTIONS WITH EMR:

Atmospheric properties, solar radiant energy characteristics with atmosphere Atmospheric Scattering, Particulate scattering & absorption, Rayleigh's & Mie's theories. Sunlight & skylight & its spectral composition, Atmospheric Windows.

UNIT V SATELLITE SYSTEM PARAMETERS AND SATELLITES AND SENSORS:

Keplers laws of orbital satellite motion, Instrumental Parameters, Viewing Parameters, Sensor Parameters, Imaging Sensor Systems
IRS, LANDSAT, SPOT, IKONOS, QUICKBIRD, RESURS, ADEOS, JERS, SPIN, ORBVIEW, OCEANSAT, NOAA, GOES, SEASAT, ASTER, CERES, MISR, MODIS, MOPITT, etc.,

UNIT VI THERMAL REMOTE SENSING:

Thermal radiation Principles, Interpreting Thermal scanner imagery, Geometric Characteristics of Across track scanner imagery, Radiometric calibration of Thermal scanners, Temperature Mapping

UNIT VII OVERVIEW ON IMAGE ANALYSIS:

Image Interpretation strategy, Interpretation of Aerial photos, and Basic elements of Image interpretation, Interpretation of Satellite Imagery, Key elements in Visual Image Interpretation.

UNIT VIII OVERVIEW ON IMAGE PROCESSING:

Introduction, Basic character of digital image, Preprocessing, Image registration, Image Enhancements, Spatial filtering, Image transformations, Image classifications.

TEXT BOOKS:

1. Remote Sensing by JAMES B. CAMPBELL Published by Taylor & Francis Ltd.
2. Remote sensing and Image interpretation by Thomas Lilliesand and Ralphw. Keifer Published by John Wiley & Sons.
3. Textbook of Remote Sensing and Geographical Information Systems M.Anji Reddy, BS Publication.
4. Remote sensing-Principles and interpretation by Floyd F Sabins.Jr. Published by Freeman & Co., New York.

GSTL-1.6 SURVEYING & THEMATIC MAPPING LAB

Surveying

Demonstration of conventional Instruments for field work, Total Station Survey in field, Downloading, Processing and generation of survey plots.

Thematic Mapping

Map reading and Interpretation, Understanding the map components. Determination of map scale, Extraction of various layered information from toposheets (Settlements, Water bodies, boundaries, Contours. etc)

Preparation of themes: Base Map, Slope, Watershed, Land Use / Land Cover, Geomorphology.

GSTL-1.7 COMPUTER LABORATORY – C, C++

Computer programmes with reference to various GST applications. Each student should develop and execute a minimum of 10 Programmes and submit in the form a record

GST-2.1 MICROWAVE AND HYPER SPECTRAL REMOTE SENSING

UNIT 1 INTRODUCTION TO MICROWAVE REMOTE SENSING:

Definition, Radiometric Quantities, Radar System Components, Source of Radiation, Radar Wave Bands, RADAR Equation, Factors Affecting Microwave Measurement, Beam Polarization And Look Angle.

UNIT II SLAR:

Definition, Radar working principle, range resolution, azimuth resolution, swath width resolution and SAR systems.

UNIT III CHARACTERISTICS OF SLAR IMAGERY:

Slant range scale distortion, ground range geometry, image displacement due to relief, layover, fore shorting, shadow and speckle.

UNIT IV INTERPRETATION OF SLAR IMAGERY:

Geometric characteristics, Electrical characteristics, Effects of polarization, Soil response, Vegetation response, urban area response.

UNIT V MICROWAVE SENSORS AND SATELLITES:

passive microwave radiometers SEASAT, SIR, ALMAZ, ERS, ENVISAT, JERS, ALOS, RADARSAT and Applications of microwave remote sensing.

UNIT VI INTRODUCTION TO HYPER SPECTRAL REMOTE SENSING:

Hyper spectral imaging, imaging spectrometers, principles of spectroscopy, hyper spectral vs multi spectral imaging.

UNIT VII ANALYSIS OF HYPER SPECTRAL IMAGING:

spectral reflectance's, spectral libraries, absorption process, analysis of spectral curve.

UNIT VIII SATELLITES AND APPLICATIONS:

Hyper spectral satellite systems viz., AVIRIS, HYMAP, HYPERION and Applications of Hyper Spectral Remote Sensing in the field of Environmental management.

Books:

1. Remote sensing and Image interpretation by Thomas Lilliesand and Ralphw. Keifer Published by John Wiley & Sons.
2. Textbook of Remote Sensing and Geographical Information Systems M.Anji Reddy, BS Publication
3. Remote sensing-Principles and interpretation by Floyd F Sabins.Jr. Published by Freeman & Co., New York.

GST-2.2 EXPERIMENTAL STATISTICS

UNIT I INTRODUCTION:

Types of proof, Generality of Applications of statistics, Examples of statistical problems

UNIT II FREQUENCY DISTRIBUTION:

Raw data, Arrays, Frequency Distributions, Class interval and Class limits, Class boundaries, Size, width of a class interval, class mark, general rules for forming frequency distributions, Histograms and frequency polygons, relative frequency distributions, cumulative frequency distributions and Ogives, Relative cumulative-frequency distribution and percentage Ogives, frequency curves and smoothed Ogives, types of frequency curves

UNIT III MEASUREMENTS AND THEIR ANALYSIS:

Introduction, Sample Versus Population, Range and Median, Graphical Representation of Data, Numerical Methods of Describing Data, Measures of Central Tendency, Standard deviation and other measures of Dispersion.

UNIT IV RANDOM ERROR THEORY:

Introduction, Theory of Probability, Properties of the Normal Distribution Function, Probability of the Standard Error, Uses of Percent Errors, Moments, Skewness and Kurtosis

UNIT V CONFIDENCE INTERVAL:

Introduction, Distributions used in Sampling Theory, Confidence Interval for the Mean, Sampling, its uses, some sampling distributions, Analysis of Variance

UNIT VI STATISTICAL TESTING:

Tests of significance, Chi-square and F-test, Non parametric tests, t-tests.

UNIT VII CORRELATION AND REGRESSION:

Curve fitting and the method of Least squares, Correlation theory, Multiple and partial correlations, Linear regression, Multiple regression, R^2 , regression modeling.

UNIT VIII STATISTICAL ANALYSIS :

Analysis of Time series, Statistical Process control and Process capability

Books:

1. Theory and Problems of STATISTICS by Murray R. Spiegel and Larry J. Stephens
2. Basics Statistics by B.L. Agarwal
3. Introduction to statistical Analysis by Wilfred J. Dixon and Frank J. Massey JR

GST-2.3 GEODESY AND GPS

UNIT I INTRODUCTION:

Definition of Geodesy, Classification of Geodesy, Geometric Geodesy, - Physical Geodesy, Physical surface of earth, The Geoid, The Ellipsoid.

UNIT II ELLIPSOID OF REVOLUTION:

Mathematical properties, The Ellipse, Basic properties of ellipse, Flattening, Eccentricity, Relationship between eccentricity and flattening, Principal parameters of ellipsoid, Parameters of commonly used ellipsoid, Use of ellipsoid as regional datum. Co ordinate system of rotational ellipsoid- Ellipsoid geographic co-ordinates, Spatial ellipsoidal coordinate system.

UNIT III COMPUTATION OR THE ELLIPSOID:

Need for mathematical surface, Reduction of baseline to mathematical surface, Reduction of baseline to reference ellipsoid, Effect or height of a point observed on the azimuth of a line, Convergence of meridians, Forward and backward Azimuths, Plane curves and geodesic line, Calculation of coordinates.

UNIT IV GRAVITY:

Expressions for gravity and potential, Geoid undulations and deflections of vertical, Measurement of gravity on earth, Reduction of gravity values.

UNIT V SATELLITE GEODESY:

Introduction, Artificial satellite, Satellite orbit, Celestial coordinate system, Geodetic position from known orbit, Coordinate transformation in equatorial plane, Range observation from three satellite positions.

UNIT VI MAP PROJECTION:

Geometry of map projections, Evolution of map projection, Development of projection surfaces, Characteristics of map projections, Equidistant projections with one standard parallel, Equidistant projections with two standard parallel, Equal area projections with straight meridians, Projections with all parallels standard, Conformal projections with straight meridians.

UNIT VII GLOBAL POSITIONING SYSTEM (GPS):

Introduction, Background, The space segment, The control segment, The user segment, The performance of GPS, Factors influencing GPS accuracy, GPS positioning. GPS signal characteristics, signal structure, signal coverage, signal propagation, Differencing of GPS data, single differenced data.

UNIT VIII GPS MATHEMATICAL MODEL AND GPS APPLICATION:

GPS mathematical model, Pseudo range mathematical model, Preparation for data processing, Baseline data computation coordinate change and satellite positions GPS receivers, Fundamentals of GPS application for various results. Making sense of GPS Techniques, GPS project planning, Possible applications like high resolution contour data.

Books:

1. Manual of Geospatial Science & Technology edited by John D. Bossler (Taylor & Francis).
2. Essentials of GPS by NK Agarwal, Spatial Network Pvt Ltd,Hyderabad.

GST-2.4 DIGITAL IMAGE PROCESSING

UNIT I DIGITAL COMPUTERS AND IMAGE PROCESSING:

Introduction: Information Systems – Encoding and decoding, modulation Satellite data – acquisition, storage and retrieval – generation of data products digital data formats. Computer basics: Hardware and Software, Networks, Image Display Subsystem, Color Display System, Hard copy System , Data Format for Digital Satellite Imagery, Image file Format and Data Compression

UNIT II PRE PROCESSING OF REMOTE SENSING DATA:

Introduction, Cosmetic Operations- Missing Scan Lines, De –stripping Methods, Geometric Corrections and Registration. Coordinate Transformations, Atmospheric Correction Methods, Illuminations and View Angle Effects, Sensor Calibration and Terrain Effects and radiometric correction methods

UNIT III IMAGE ENHANCEMENT TECHNIQUES:

Introduction, Human Visual Systems, Contrast Enhancement- Linear Contrast Stretch, Histogram Equalization, Guassian Stretch, Pseudo Color Enhancement- Density Slicing, Pseudo Color Transform.

UNIT IV IMAGE TRANSFORMS:

Introduction, Arithmetic Operations- Image Addition, Subtraction, Multiplication and Division. Empirically Based Image Transforms- Perpendicular Vegetation Index, Tasseled Cap Transformations, NDVI. Principal Component Analysis

UNIT V IMAGE FILTERING TECHNIQUES:

Introduction, Low Pass Filters- Moving Average Filters, Median Filters, Adaptive Filters, High Pass Filters- Image Subtraction Method, Derivative Based Method, Frequency Domain Filters, Filtering for Edge Enhancement

UNIT VI IMAGE CLASSIFICATION:

Introduction, Geometrical Basis of Classification, Unsupervised classification, Supervised Classification Training Samples, Statistical Parameters and Classifiers

UNIT VII IMAGE CLASSIFICATION ACCURACY ASSESSMENT:

Image classification accuracy assessment, Performance analysis, Various Band Data for Land use, Land Cover Classification System with Case Studies.

UNIT VIII IMAGE CLASSIFICATION AND GIS INTEGRATION:

Image Classification and GIS Integration and Linkage. Software: ERDAS, Geomatica, ENVI and e-Cognition

Textbooks:

1. John, R. Jensen, Introductory Digital Image Processing – Prentice Hall, New Jersey, 1986.
2. Robert, A. Schowengerdt. Techniques for image processing and classification in Remote Sensing, 1983.
3. Hord, R.M. Digital Image Processing, Academic Press Pub. 1982.
4. Paul. M. Mather- Computer Processing of RS Images, Wiley

GST-2.5 GEOGRAPHICAL INFORMATION SYSTEMS

UNIT I INTRODUCTION:

Introduction, Definitions of GIS and related terminology, The Evaluation of GIS, Components of GIS, Geospatial data, Spatial data infrastructure.

Map language

Introduction, Map as a model, Spatial elements and terminology, Classification of maps, Map scale, Spatial referencing system, Computers in map production, Trends in computer construction, General software's in map production.

UNIT II FUNDAMENTALS OF GIS:

A brief history of GIS, GIS architecture, Components of a GIS, GIS workflow, Theoretical models of GIS: Functional elements, Fundamental operations, Theoretical framework, GIS categories, Levels of measurement.

UNIT III SPATIAL DATA MODELLING:

Introduction; Stages of GIS data modeling; Graphic representation of Spatial Data, Raster data representation, Vector data representation, Spatial data models; Raster GIS models: Types of raster GIS models, Compact raster data models; Vector GIS models, Spaghetti model, Topological model, Shape file, Compact vector data models; Comparison of Raster and Vector Models.

UNIT IV GIS DATA MANAGEMENT:

Introduction, Database management systems: Functions of DBMS, Components of DBMS; GIS data file management: Simple list, Ordered sequential files, Indexed files, Building GIS worlds; Database models: Hierarchical database models, Network systems, Relational database models, Standard query language (SQL), Storage of GIS data, The hybrid data model, The integrated data model; Object based data models: Entity-Relationship-Attribute model, Organizational strategy of DBMS in GIS.

UNIT V DATA INPUT, DATA EDITING AND DATA QUALITY:

Introduction, The data stream, Data input methods: Keyboard entry, Manual digitizing, Scanning and automatic digitizing; GPS for GIS data capture

UNIT VI DATA EDITING:

Data editing, Detecting and correcting errors, Data reduction and generalization, Edge matching and Rubbersheeting

UNIT VII DATA QUALITY:

Components of data quality. Accuracy, Precision and resolution, Consistency, Completeness, Sources of error in GIS; Modeling errors, Point data error models, Line and area data error models, Models for dot and pixel counting; Error evaluation by graphical methods.

UNIT VIII GIS APPLICATIONS:

Remote sensing and GIS Linkage, GIS softwares, Case studies

Books:

1. Manual of Geospatial Science and Technology Edited By John. D. Bossler, Taylor And Francis, London
2. Text book of Remote sensing and GIS by M. Anji Reddy, BSP Publications, Hyderabad.
3. Geographical Information Sysytems by Demmeers

GSTL-2.6 DIGITAL IMAGE PROCESSING LAB

Image Processing on various software

- To view the data available in a tape / to load data from tape to disk / Selection and extraction of Study area.
- Geometric Correction.
- Image rectification
- Merging lines, columns and bands, Filtering Techniques, Edge Enhancement, Histogram calculation
Generation of training sets-
- Generating Confusion Matrix- Separability Analysis
- Computation of training set statistics- Supervised classification- Creation of lookup table
- Legend creation-
- Unsupervised Classification
- Texture Analysis
- Map Composition and Output Generation

GSTL-2.7 FIELD SPECTROSCOPY LAB

- **Hyper spectral imaging**
- **Development of Spectra for:**
 - Concrete
 - Vegetation
 - Soil
 - Water etc.,

GST-3.1 DIGITAL PHOTOGAMMETRY

UNIT I IMAGE ACQUISITION:

Introduction, Geometry of aerial and Spatial pictures, Digital image acquisition with airborne CCD cameras

UNIT II SCANNERS:

Scanners for digitization of aerial pictures, Geometric precision in digital imagery, Image improvements, Storage and data Compression of digital images.

UNIT III APPLICATION OF GPS IN PHOTOGRAMMETRY:

Introduction, Integrated GPS flight management system, The Navigation, Determination prospective centres for aero triangulation, The tragectography, Airplane altitude measurement, Aerial triangulation using GPS data.

UNIT IV DIGITAL PHOTOGRAMMETRIC WORKSTATIONS:

Introduction, The technology and Equipment, Data input, Stereoscopic Visualization, Display of Images, Image Processing Epipolar resampling, Functionality management of data.

UNIT V 3D DATA ACQUISITION FROM VISIBLE IMAGES:

Introduction, Formulations of an automatic individual point matching process, Stereo matching from Image space(SMI), Stereo matching from Object space(SMO), DSM generation.

UNIT VI EXTRACTION OF CHARACTERISTIC LINES OF RELIEF:

Definitions, Extracting from starting points, Calculation of drained surfaces, Extraction from local properties, Hydrographic network, Cartographic smoothing.

UNIT VII DIGITAL SURFACE MODELS:

Overview, DSM, DEM, DTM definitions, DEM Specification, Digital models representation Triangular Irregular Network (TIN), Surface characteristic lines, DSM quality, Grid structure, Grid density, Data format, Internal and External validation.- Terrain Modelling

UNIT VIII PRODUCTION OF DIGITAL ORTHO PHOTOGRAPHS:

Introduction, Line off, Join up, Radiometric balancing, homogeneity of radiometry, Difficulties in Landscape.

Books:

1. Elements of Photogrammetry by Paul R. Wolf, Mc. Graw Hill
2. Digital Photogrammetry by M. Kasser and Y. Egels, Taylor and Francis Ltd.
3. Digital Photogrammetry – An addendum to Manual of Photogrammetry by Tina Cary, Jhon Jenson and Maury Nyquist by American Society of Photogrammetry and Remote Sensing(USA).

GST-3.2 SPATIAL DATA ANALYSIS & MODELING

UNIT I VECTOR DATA ANALYSIS:

Buffering, Overlay, Distance Measurement, Pattern Analysis, Map Manipulation.

UNIT II RASTER DATA ANALYSIS:

Data Analysis Environment, Local Operations, Neighborhood Operations, Zonal Operations, Physical Distance Measure Operations, Other Raster Data Operations , Comparison of Vector- and Raster-Based Data Analysis .

UNIT III TERRAIN MAPPING and ANALYSIS:

Data for Terrain Mapping and Analysis, terrain Mapping, slope and Aspect, Surface, Curvature, Raster Versus TIN.

UNIT IV VIEWSHEDS AND WATERSHEDS:

View shed Analysis, Parameters of View shed Analysis, Application of View shed Analysis, Watershed Analysis, Factors Influencing Watershed Analysis, Applications of Watershed Analysis

UNIT V SPATIAL INTERPOLATION:

Elements of Spatial Interpolation, Global Methods, Local Methods, Kriging , Comparison of Spatial Interpolation.

UNIT VI GEOCODING AND DYNAMIC SEGMENTATION:

Geocoding, Application of Geocoding, Dynamic Segmentation, Application of Dynamic Segmentation.

UNIT VII PATH ANALYSIS AND NETWORK APPLICATIONS:

Path Analysis, Application of path Analysis, Network, Putting Together a Network, Network Application.

UNIT VIII GIS MODELS AND MODELING:

Basic Elements of GIS Modeling, Binary Models, Index Models, Regression, Models, Process Models.

Text Books:

1. Fundamentals of GIS by MICHAEL N DEMERS. Published By John Wiley & Sons Inc.
2. Environmental Modelling with GIS, Michael F. Goodchild, Bradley O. Parks, Louis T. Steyaert
3. Introduction to Geographic Information Systems By Kang-Tsung Chang (TATA McGRAW-HILL EDITION).
4. Ormsby T.E.Napoleon,R.Burke,C.groessler,L.Feaster 2004.Getting to know Arc GIS Desktop,ESRI Press
5. 2. Burke R.T.Tilton,A.Arana 2003 Getting to Know ArcObjects.ESRI Press

GST-3.3 DATABASE MANAGEMENT SYSTEMS (DBMS)

UNIT I INTRODUCTION:

Database System Applications- Database System versus File System- Components of DBMS- View of Data- Data Models- Database Languages- Leading Commercial Databases- Database Users- Data-Administrator- Database-Administrator- Transaction Management- Database System Structure.

UNIT II DATA BASE DESIGN:

Data Models: Entity-relationship model- Relational Model- Object-oriented model- Constraints- Keys- Entity-relationship Diagram- Weak Entity Sets- Design of an E-R Database Schema- Reduction of an E-R Schema to Tables- Structure of Relational Databases- Data Domain- Keys- Data Normalization- Normal Forms.

UNIT III RELATIONAL DATABASES:

SQL: Basic Structure- Simple SQL queries- Set Operations- Aggregate Functions- Null Values- Nested Sub queries- Views- Complex Queries- Modification of the Database- Embedded SQL. **Integrity & Security:** Domain Constraints- Integrity and Referential Integrity Constrains- Assertions- Triggers- Security and Authorization- Authorization in SQL.

UNIT IV DATABASE STORAGE:

Storage & File Structure: Overview of Physical Storage Media- Magnetic Disks- Storage Access- File Organization- Organization of records in Files- Data-Dictionary Metadata). **Indexing & Hashing:** Basic Concepts- Ordered Indices- B+ -Tree Index Files- B-Tree Index Files- Static Hashing- Dynamic Hashing.

UNIT V FORMS- REPORTS AND APPLICATIONS:

Effective Design of Reports and Forms- Form Layout- Creating Forms- Direct manipulation of Graphical Objects- reports- Application Features.

UNIT VI TRANSACTION MANAGEMENT:

Transaction Concept- Transaction State- Transaction Properties (ACID)- Multiple Users and Concurrent Executions- Serializability.

UNIT VII CONCURRENCY CONTROL:

Lock-Based Protocols- Two-phase Locking Protocol- Multiple Granularity Protocol- Timestamp-Based Protocols- Timestamp Ordering Protocol- Multiversion schemes- Deadlock Handling.

UNIT VIII RECOVERY SYSTEM:

Failure Classification- Storage Structure- Recovery and Atomicity- Log-Based Recovery- Check Point- Shadow paging- Recovery with Concurrent Transactions.

Books:

1. Database System Concepts by Silberschatz- McGraw Hill Editon.
2. Database Management Systems by Gerald V Post- Tata Mc-Graw Hill edition.
3. Database Management Systems by Ramakrishnan- Tata Mc-Graw Hill edition.

GST-3.4 ENVIRONMENTAL IMPACT ASSESSMENT

UNIT I CONCEPTUAL FACTS OF EIA:

Introduction, Definition and Scope of EIA, Objectives in EIA, Basic EIA Principles, Classification of EIA: Strategic EIA (SEIA), Regional EIA, Sectoral EIA, Project Level EIA and Life Cycle Assessment, Project Cycle, Grouping of Environmental Impacts: Direct Impacts, Indirect Impacts, Cumulative Impacts and Induced Impacts. Significance of Impacts: Criteria/Methodology to Determine the Significance of the Identified Impacts.

UNIT II BASELINE DATA ACQUISITION:

Environmental Inventory, Data Products and Sources: thematic data, topographical data, collateral data and field data. Environmental Baseline Monitoring (EBM), Preliminary Study to determine impact significance, Environmental Monitoring network Design, Monitoring Stations, Air quality data acquisition, Water Quality data acquisition, soil data, socioeconomic data and biological data acquisition. Impact on Environmental Components: Significance of Impacts, Criteria to determine the significance of the identified Impacts.

UNIT III PLANNING AND MANAGEMENT OF IMPACT STUDIES:

Conceptual Approach for Environmental Impact Studies, Proposal Development, Interdisciplinary Team Formations, Team Leader Selection and Duties, General Study Management, Fiscal Control.

UNIT IV OPERATIONAL ASPECTS OF EIA:

Screening: Application for Prior Screening for Environmental Clearance, Screening Criteria; Category A Projects, Category B Projects, Criteria for Classification of Category B1 and B2 Projects, Consistency with other Requirements and Siting Guidelines. Scoping: Identification of Appropriate Valued Environmental Components(VEC), Identification of Impacts, Information in Form 1, Structure of a Pre-feasibility Report. Public consultation: Appraisal, Decision Making, Post-clearance Monitoring Protocol.

UNIT V METHODS FOR IMPACT IDENTIFICATION:

Background Information, Interaction-Matrix Methodologies: simple matrices, stepped matrices, development of a simple matrix, other types of matrices, summary observations on matrices, Network Methodologies: Checklist methodologies, simple checklists, descriptive Checklists, summary observations on simple and descriptive Checklists.

UNIT VI PREDICTION OF IMPACTS (AIR AND WATER):

Air Environment: Basic information on air quality, Sources of Pollutants, effects of pollutions, Conceptual approach for addressing air environment impacts, Air quality standards, Impact Prediction, Impact significance. Water Environment: Basic Information on surface-Water Quantity and Quality, Conceptual Approach for Addressing Surface-Water-Environment Impacts, Identification of Surface-Water Quantity or Quality Impacts, Procurement of Relevant Surface-Water Quantity-Quality Standards, Impact Predictions, Assessment of Impact Significance.

UNIT VII PREDICTION OF IMPACTS (NOISE, SOIL, BIOLOGICAL AND SCIO-ECONOMIC):

Basic Information on Noise Key Federal Legislation and Guidelines, Conceptual Approach for Addressing Noise-Environment Impacts, Identification of Noise Impacts, Procurement of Relevant Noise Standards and/or Guidelines, Impact Prediction, Assessment of Impact Significance. Soil Environment: Human Health and Society, Biological Environment: Basic Information on Biological Systems, Conceptual Approach for Addressing Biological Impacts, Identification of Biological Impacts, Description of Existing Biological Environment Conditions, Procurement of Relevant Legislation and Regulations, Impact Prediction, Assessment of Impact Significance.

UNIT VIII ENVIRONMENTAL MANAGEMENT PLAN (EMP):

Case Study, identification of Impacts, EMP for Air Environment: Dust Control Plan, Procedural Changes, Diesel Generator Set Emission Control Measures, Vehicle Emission Controls and Alternatives, Greenbelt Development. EMP for Noise Environment, EMP for Water Environment: Water Source Development, Minimizing Water Consumption, Domestic and Commercial Usage, Horticulture, Storm Water Management. EMP for land Environment: Construction Debris, hazardous Waste, Waste from temporary Labour settlements.

Text Books:

1. Textbook of Environmental Science & Technology by M.Anji Reddy, BS Publications, 2010
2. Technological guidance manuals of EIA. MoEF.
3. EIA by Canter

GST-3.5 GST FOR NATURAL RESOURCES MANAGEMENT

UNIT I LAND RESOURCES:

Appropriate methodology, Rapid land use assessment, Rapid land use information system. Land evaluation and suitability studies by Remote sensing and GIS. Techniques of land use / land cover map preparation. Land use / land cover mapping and planning. Dynamic urban land use, Semi dynamic land use.

UNIT II MUNICIPAL & URBAN GIS:

GST for Urban Environmental Monitoring. GST for Municipal Administration. Geomatics in Solid and Hazardous waste disposal site selection, Environmental Information System Development for municipalities: Case studies GST for Traffic and Transportation planning assessment

UNIT III GEOSCIENCES:

Role of Remote sensing and GIS in geological studies and case studies. Evaluation of Geological Mapping, Introduction to Prospection Techniques, History of Remote Sensing in Geological Exploration. Image Lineaments and structural origin, Prospecting, Applications of thermal and Radar remote sensing in structural geology. Spectral response of Minerals, Rocks, Alterites, case studies

UNIT IV WATER RESOURCES:

The hydrological cycle, Hillslope hydrology, The drainage basin, Channel networks, Automatic derivation of catchment characteristics, The global cycle. Ground water exploration and targeting. Introduction, Characteristics, Watershed and people, Watershed characteristics, watershed management and Integrated approach for sustainable planning. Water quality modeling. Watershed Management in India, Case studies

UNIT V AGRICULTURE:

Soil and altitude, Soil and aspect, Soil and slopes, Soil landscapes, Soil erosion modeling. Crop type classification, area estimates, and spectral response of different crops. Crop diseases and Assessment, Crop and Water management and monitoring. Advances in Crop monitoring.

UNIT VI FORESTRY:

Survey and mapping of forest cover, Forest change detection, Forest damage assessment and Forests monitoring, Land evaluation for forestry.

UNIT VII ECOSYSTEM MODELING:

Spectral response of vegetation and mapping, Ecosystem Analysis, Environmental impact analysis and monitoring, Ecosystem modeling, Wetland mapping. Spatial Models of Ecological Systems and Process.

UNIT VIII DISASTER MANAGEMENT:

Introduction and Overview- Natural and man made hazards – Vulnerability assessment and Mapping on Disasters- Spatial Information for natural Hazard and risk assessment -Land slides- volcanoes- floods and famines- earth quakes- Drought hazard and risk assessment- Human Induced disasters- industrial disasters- dams- constructional and others.

Books:

1. Good child : Environmental Modeling With GIS
2. Manual of Geospatial Science and Technology Edited By John. D. Bossler, Taylor And Francis, London
3. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, New York, 1987.
4. Geographical Information Systems by David Martin
5. RS in Geology by Siegal
6. RS in Forest Resources by John. A. Howard, Chapman and Hall.

GSTL-3.6 DIGITAL PHOTOGRAMMETRY LAB

- Digital Photogrammetric Stereo Workstation: hardware, viewing system, measurement system,
- feature extraction:
- vector information: breaklines for automatic digital terrain model extraction, connection to CAD systems
- Systems and Microstation with ERDAS PRO600
- Automatic generation of terrain models: image matching procedures, analysis Semi-automatic building extraction: matching procedures, measurement of simple and complex building structures
- Patternisation: Export Symbols from Microstation to ERDAS
- Typical end product Orthophoto production and ortho mosaicing: handling of image blocks, geometric radio-metric adjustment and tools, examining typical problems in different data sets

End Products : map composition and layers (3D)

GSTL-3.7 GIS & GPS LAB

GPS Lab:

Alignment survey by handheld GPS, Processing of GPS survey data with GIS software, Surveying and data capture by using DGPS and data Processing, Contour Development with DGPS processed data.

GIS Lab:

- **Scanning, Digitization ,**
 - **Integration of remote sensing and GIS:**
1. Creation of Personal Geo-database, Feature Dataset and Feature Classes using Arc Catalog.
 2. Geo-referencing of Raster Image using Arc Map.
 3. On Screen Digitization using Arc Map.
 4. Editing of Spatial Features using Arc Map.
 5. Addition of Tabular Data to Feature Class & their editing.
 6. Defining Domains in a Feature class for adding field values.
 7. GPS linkage and attribute data entry.
 8. Creation, Validation and Modification of Topology.
 9. Viewing of GIS data using Arc Catalog/Arc Map.
 10. Selection of features.
 11. Labeling using Arc Map.
 12. Symbolization using Arc Map.
 13. Creation of Graph using Arc Map.
 14. Generation of Report.
 15. Creation of Layout using Arc Map.