

ACADEMIC REGULATIONS & COURSE STRUCTURE

For

SPATIAL INFORMATION TECHNOLOGY

(Applicable for batches admitted from 2016-2017)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I Semester

S. No.	Subject	L	P	Credits
1	Principles of Photogrammetry	4	-	3
2	Principles of Remote Sensing	4	-	3
3	Principles of Geographical Information Systems	4	-	3
4	Digital Image Processing	4	-	3
5	Object Oriented Programming through JAVA	4	-	3
6	Elective – I I. Data Base Management Systems II. Principles of Geo-Data Base III. Web Technologies	4	-	3
7	Map Analysis & Photogrammetry Lab and Satellite Image Interpretation Lab	-	4	2
Total Credits				20

II Semester

S. No.	Subject	L	P	Credits
1	Geodesy and GNSS	4	-	3
2	Internet GIS	4	-	3
3	Advanced Remote Sensing	4	-	3
4	GIS Analysis & Applications	4	-	3
5	Remote Sensing and GIS for Natural Resource Management	4	-	3
6	Elective – IV I. RS & GIS Disaster Management II. Data Warehousing & Data Mining III. Advanced Surveying & Cartography IV. Digital Photogrammetry V. Geo-Statistical Methods	4	-	3
7	Digital Image Processing Lab & GIS & GPS Lab	-	4	2
Total Credits				20

III Semester

S. No.	Subject	L	P	Credits
1	Comprehensive Viva-Voce	--	--	2
2	Seminar – I	--	--	2
3	Project Work Part – I	--	--	16
Total Credits				20

IV Semester

S. No.	Subject	L	P	Credits
1	Seminar – II	--	--	2
2	Project Work Part - II	--	--	18
Total Credits				20

I Year I Semester	PRINCIPLES OF PHOTOGRAMMETRY	L	P	C
		4	0	3

UNIT- I

Introduction – Definition of Photogrammetry - types of photographs – Geometry of vertical photographs, Scale of a vertical photograph over flat terrain, over variable terrain - average photo scale, methods of determining scale of vertical photographs, Flying height of a vertical photograph Stereoscopic viewing of Vertical photographs – depth perception; overlap, side lap; flight planning; vertical exaggeration - factors involved and determination.

UNIT II

Relief displacement on vertical photographs

Photographic “Flight-Line” Axes for Parallax Measurement – Monoscopic methods Parallax measurement – Principle of the Floating Mark – Stereoscopic methods of Parallax Measurement

– Parallax equation – Elevations by parallax Differences – Approximate Equation for elevations from Parallax Differences – Measurement of Parallax Differences- Parallax Correction Graph – Computing Flying Height and Air Base – Mapping with Stereoscope and Parallax Bar – ; Y-parallax Error Evaluation. . Determination of Horizontal ground length, directions and angles from photo coordinates.

UNIT III

Elements of air photo pattern – rock types, landforms, surface drainage patterns, Erosion features, photographic gray tones, vegetative details, cultural details, boundary characteristics, micro details of the terrain.

UNIT IV

Elementary Methods of Planimetric Mapping With Vertical Photographs: Planimetric Mapping by Direct Tracing – Planimetric Mapping with Reflection and Projection Instruments – Georeferencing of Digital Imagery – Planimetric Mapping Using a Tablet Digitizer – Heads-up Digitizing.

UNIT V

Photo Elements and Mosaics – Advantages and disadvantages of photomaps and mosaics - uses of photomaps and mosaics, types of mosaics, Materials for preparing mosaics, Mosaic construction. – Orthophoto mosaics- Reproduction.

TEXT BOOK:

1. Elements of Photogrammetry by PAUL R. WOLF
2. Lillisand T.M and R.W.Kiefer (1994) 4th edition. Remote sensing and image interpretation, John Wiley & Sons, New York.
3. Sabins F.F Jr Latest Remote Sensing: Principles and Interpretation, W.H.Freeman & Co., New York.

REFERENCE:

1. Manual of Photogrammetry – American Society of Photogrammetry By ALBERT.D
2. Principles and Applications of Photo Geology By SHIV PANDEY
3. Photogrammetry- Vol I by Krauss, J., - Springer – Verlag Publications
4. Photogrammetry 3rd Edition by Moffitt, Francis H. & Mikhail, Edward M., - Harper and Row Publishers.HH

I Year I Semester	PRINCIPLES OF REMOTE SENSING	L	P	C
		4	0	3

UNIT- I

Introduction of Remote Sensing, Electro Magnetic Spectrum - Energy interaction with Atmosphere - Scattering - Different types - Absorption - Atmospheric window - Energy interaction with surface features - Spectral reflectance of vegetation soil and water – Atmospheric influence on spectral response patterns.

UNIT- II

Satellite Platform and Data products: Types of Platforms, types of sensors, Resolutions, satellite orbits, scanning mechanism, Satellite data types, ground truth data collection Instruments used for ground truth data collections.

Satellite programs of the world – geostationary, sun synchronous, meteorological, ocean monitoring and telecommunication satellites, LANDSAT, SPOT, IRS, **MODIS**, IKONOS, Cartosat Oceansat, NOAA and Other recent satellites. **Seasat, Radarsat, RISAT, ASTER, SRTM**

UNIT-III

Thermal Remote Sensing: Radiant flux – heat transfer – thermal infrared radiation – thermal properties of materials – emissivity of materials – thermal inertia of Earth surface features. Thermal IR detection and imaging – characteristics of TIR images. Factors controlling IR Survey
– applications.

UNIT-IV

Microwave remote sensing: Definitions-aircraft radar system – SLAR
– components, imaging system, wavelengths – range and azimuth resolution – real aperture and synthetic aperture systems, geometry of radar Images - mosaics. Image characteristics: Polarization, look direction and look angle – radar image interpretation, different platforms and Sensors,

UNIT-V

Hyperspectral Remote Sensing - Spectroscopy, Image cube, AVIRIS, Spectral matching, Data Libraries, Application of Hyperspectral data, MODIS.

TEXT BOOKS:

1. George Joseph,(2005) Fundamentals of Remote sensing 2nd edition , University press, Pvt, Ltd, Hyderabad
2. James .B. Campbell , Randolph H. Wynne, Introduction to Remote Sensing- The Guilford press, 2011.
3. Sabins F.F Jr Latest Remote Sensing: Principles and Interpretation, W.H.Freeman & Co., New York.
4. Lillisand T.M and R.W.Kiefer (1994) 4th edition. Remote sensing and image interpretation,

John Wiley & Sons, New York.

5. Floyd M. Handerson and Anthony, J. Lewis, “Principles and Application of Imaging Radar”
6. Shir N. Pandey Principles of Remote Sensing , Newage International Publishers..
7. Curran P. J(1985) Principles of Remote Sensing,Longman,Essek.
8. Hayesm L., [1991] Introduction to Remote Sensing, Taylor and Fransis Publication, London.

REFERENCES:

1. Remote sensing by James B. Campbel, published by Taylor & fancies Ltd.
2. John R. Jensen “ Remote sensing for Environment”pearson edition Pvt Ltd, New Delhi
3. Alexey Bunkin and Konstantin Voliak, Laser Remote Sensing of the Ocean, John Wiley and Sons. 2001, Canada.
4. Gibso, P., and Clare H.Power, [2000] Introductory Remote Sensing Principles and concepts, Routledge, 1st edition, London.
5. Ulaby, F.T., Moore, R.K. AND Fung, A.K., “Microwave Remote Sensing Active and Passive”, Vol. 1,2 and 3, Addison – Wesley Publication

I Year I Semester	PRINCIPLES OF GEO-GRAPHICAL INFORMATION SYSTEMS	L	P	C
		4	0	3

UNIT –I

Components of GIS, GI System, HW and SW Requirement

INTRODUCTION TO GIS SPATIAL ANALYSIS: Spatial Elements, Spatial Measurement Level, Spatial Location and Reference, Spatial Patterns, Geographic Data Collection, Populations and Sampling Schemes, Inferences from Samples,

Map Scale, Map Characteristics, Map Projections, Grid Systems for Mapping, The Cartographic Process, Map Symbolism, Map Abstraction and Cartographic Databases, Thematic maps and associated common problems.

UNIT- II

CARTOGRAPHIC AND GIS DATA STRUCTURES : Computer Database Structures for Managing Data, Hierarchical Data Structures, Network Systems, Relational Database Management Systems, **OODBMS**

UNIT -III

GIS Data Models & Input Devices: Graphic Representation of Entities and Attributes, GIS Data Models for Multiple Coverage's, Raster Models, Storing of Raster Data, Vector Models, Input Devices, Raster, Vector, Reference Frameworks and Transformation, Map Preparation and the Digitizing Process, Methods of Vector Input, Method of Raster Input, Remote sensing, Raster Data Input, External Databases. **Spatial and Non spatial Analysis/Queries, Presentation of Results**

UNIT -IV

DATA STORAGE AND EDITING: Storage of GIS Databases, Editing the GIS Database, Detecting and Editing Errors of Different Types, Entity Errors: Vector, Attribute Errors: Raster and Vector, Dealing with Projection Change, Edge Matching, Conflation and Rubber Sheeting, Templating.

UNIT -V

GIS Design and Implementation: GIS Design, Internal and External GIS Design, Software Engineering Approach, System Design Principles, System Development Waterfall Mode, Structured Designed Model, Technical Design, Cost/Benefit Issues, Data and Applications Requirements Models, Formal GIS Design Methodology, The Spiral Model, Rapid Prototyping, Database Design Study Area, Scale, Resolution, and Level of Detail, Classification, Coordinate System and Projection.

TEXT BOOK:

1. Michael N Demers , FUNDAMENTAL OF GIS , 4th edition Published by John Wiley & Sons Inc
2. Burrough P.A., Principles of GIS , Rachael Mc Donnell.
3. Rolf A.de Principles of GIS , ITC Education series :1,3rd Edition.

REFERENCES:

1. Jeffrey Star and John Estabrook Geographic Information System- An Introductory , Prentice Hall Inc.
2. Marble, D.F and Calkins, Basic Readings In Geographic Information System ,H.W – Spad Systems Ltd.
3. A.M. Chandra and S.K. Ghosh 2000.Remote Sensing and GIS . Narosa Publishing House, New Delhi.
4. Lo.C.P., Yeung. K.W.Albert (2002) Concepts and Techniques of Geographic Information Systems, Prentice - Hall of India Pvt ltd. New Delhi.
5. Kvale, IR, Netherlands

I Year I Semester	DIGITAL IMAGE PROCESSING	L	P	C
		4	0	3

UNIT -I

Introduction - Image processing display systems. Initial statistical extraction - univariate and multivariate statistics, histogram and its significance in remote sensing data. Preprocessing - Introduction, missing scan lines, desk tripping methods, geometric correction and registration, atmospheric corrections, illumination and view angle effects and orthorectification, resampling, radiometric correction - Noise models.

UNIT- II

Sensor and Data model: Sensor model – Resolutions - Pixel characters
– Image formation and its significance - Spatial Statistics

UNIT- III

Image Enhancements: Spatial enhancement - Spectral signatures - Image characteristics, ratioing, feature space scatterogram - Point, local and regional operation - Fourier transform; scale-space transform, wavelet transform, multi-image fusion

UNIT -IV

Information Extraction: Classification - Feature extraction, training – Supervised, Unsupervised and Hybrid training, Non-parametric and sub-pixel classification, Hyper-spectral Image analysis, Sources of Classification Error, Error Characteristics, Interpretation of the Error Matrix. Measurement of Map Accuracy, Nature of Change Detection, Change Detection algorithms.

UNIT- V

Image Analyses: Pattern recognition, boundary detection and representation, textural and contextual Analysis, decision concepts - Fuzzy sets, evidential reasoning. Expert system, Artificial Neural Network - Integration of data.

TEXT BOOKS:

1. John R.Jenson, “Introductory Digital Image Processing”, Prentice Hall Series, 1996.
2. John A.Richards, Springer-Verlag, “Remote Sensing Digital Image Analysis” 1999.
3. Rafael C.Gonzalez, “Digital Image Processing (2nd Edition)”, Prentice Hall, 2002.

REFERENCES

1. David L. Verbyla “Satellite Remote sensing of Natural Resource Management”, Lewis publishers, Florida
2. Anil K. Jain “Fundamentals of Digital Image Processing” Prentice Hall Publications, USA.

I Year I Semester	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	L	P	C
		4	0	3

UNIT-I Introduction

Introduction to OOPS: Paradigms of Programming Languages - Basic concepts of Object Oriented Programming – Differences between Procedure Oriented Programming and Object Oriented Programming - Objects and Classes – Data abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic binding, Message communication – Benefits of OOP – Application of OOPs.

Introduction to Java: Importance of Java to internet, byte code, Java buzzwords, data types, variables, declaring variables, dynamic initialization, scope and life time of variables, type conversion and casting, compiling and running of simple Java program.

UNIT-II Arrays, Control Structures , Classes and Objects

Arrays, Operators, control statements, Concepts of classes and objects, class fundamentals Declaring objects, assigning object reference variables, introducing methods, constructors, usage of static with data and methods, usage of final with data, access control, this key word, garbage collection, overloading methods and constructors, parameter passing - call by value, recursion, exploring the String class.

UNIT-III Inheritance,Packages and Interfaces

Inheritance Basic concepts, member access rules, usage of super key word, forms of inheritance, method overriding, abstract classes, dynamic method dispatch, using final with inheritance, the Object class.Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT-IV Exception Handling and Multithreading

Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes, Concepts of Multithreading, differences between process and thread, thread life cycle,creating multiple threads using Thread class, Runnable interface, Synchronization, thread priorities, inter thread communication.

I/O Streams: File –Streams, Advantages, The stream classes, Byte streams, Character streams.

UNIT-V Event Handling and AWT Controls

Applets - Concepts of Applets, differences between applets and applications,life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Abstract window tool kit - Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

AWT components : Concepts of components, container, panel, window, frame, canvas, Font class, Color class and Graphics. Buttons, Labels, Text fields, Text area, Check boxes, Check box groups, Lists, Choice, Scrollbars, Menus, Layout Managers.

TEXT BOOKS

1. The Complete Reference Java J2SE 7th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi.
2. Big Java 2nd Edition, Cay Horstmann, John Wiley and Sons.

I Year I Semester		L	P	C
		4	0	3

DATABASE MANAGEMENT SYSTEMS (ELECTIVE – I)

UNIT I : Introduction

Database System Applications- Database System versus File System-Components of DBMS- View of Data- Data Models: Object Based Logical Model, Record Base Logical Model (Relational Model, Network Model, and Hierarchical Model), Database System Architecture – History of Database Systems. Entity-Relationship Model: Basic Concepts – Constraints – Keys –Design Issues – Entity Relationship Diagram – Weak Entity Sets – Extended E-R Features – Design of an E-R Database Schema – Reduction of E-R Schema to Tables.

UNIT II : Relational Model

Structure of Relational Databases – Relational Algebra – Tuple Relational - Calculus – Domain Relational Calculus. SQL: Background
– Basic Structure – Set - Operations – Aggregate Functions – Null Values – Nested Subqueries
– Views – Complex Queries –Modification of the database – Joined Relations – Data-Definition Language. Other Relational Languages: Query-by-Example.

UNIT III: Relational-Databases

Domain Constraints – Referential Integrity – Assertions – Triggers – Security and Authorization. **Relational-Database Design:** Normalization -first normal form , second normal form, third normal form, Boyce-Codd normal form, fourth normal form.

Spatial Database Extensions: Introduction to Spatial Extensions - PostGIS, Oracle Spatial, SQL spatial, MySQL spatial

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.

Indexing & Hashing: Basic Concepts- Ordered Indices- B+ -Tree Index Files- B-Tree Index Files- Static Hashing- Dynamic Hashing.

UNIT V : CONCURRENCY CONTROL & RECOVERY SYSTEM

Multiple Users and Concurrent Executions- Serializability. Lock-Based Protocols- Two phase Locking Protocol- Multiple Granularity Protocol-TimestampBased Protocols. Recovery System: Failure Classification-Storage Structure- Recovery and Atomicity- Log-Based Recovery-Shadow paging.

TEXT BOOK:

1. Silberschatz, Korth, Sudarshan, *Database System Concepts*, 4th Edition
– McGraw-Hill Higher Education, International Edition 2005.
2. **Database Management Systems** by Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition.

REFERENCES:

1. Database Management Systems by P.Radha Krishna HI-TECH Publications 2005.

I Year I Semester	PRINCIPLES OF GEODATA BASE	L	P	C
		4	0	3

UNIT -I

Introduction to DBMS – Brief history – types of DBMS – data models
– ER model: concepts – design. GIS data model: Conceptualizing the real world in GIS.

UNIT -II

Relational Data Base Management Systems: Concepts – Constrains – Relational Data base Design – Relational Models Extended with ADT. SQL – simple – complex –spatial join.

UNIT -III

Representation of Spatial Objects: Geographic space modeling – Representation Modes – Representing the Geometry of a Collection of objects – Spatial data formats and Exchange formats – Spatial Abstract data Types. – Object Oriented GIS

UNIT- IV

Geodata Base: Arc Geodatabase – topology – defining the relationship class – geometric networks – Geocoding services – Building geodatabases with CASE tools

UNIT -V

Emerging Trends: Data Mining: concepts – application of data mining, Data Warehousing: Characteristics of Data Ware house – applications, Intelligence Decision making: Artificial Intelligence, Decision support system, Expert system – components – design – applications.

REFERENCES:

1. Korth and Silberschatz (2002) Database System Concepts - McGraw - Hill Book Company
2. Rigaux, P., Scholl, M., Voisard, A. (2002). Spatial Applications - with Application to GIS, Morgan Kaufmann
3. Ramiz Elmarsi & Shenkant B – Navatha (2002) “Fundamentals of Database System” 3rd Edition, Pearson Education: New Delhi.
4. Buliding Geodata Base (2002) GIS by ESRI publication, USA
5. Thomas Ott, Frank Swiaczny (2000) Time-Integrative Geographic Information Systems, Springer

I Year I Semester	WEB TECHNOLOGY	L	P	C
		4	0	3

UNIT I

INTRODUCTION : History of the Internet and World Wide Web – HTML 4 protocols – HTTP, SMTP, POP3, MIME, IMAP. Introduction to JAVA Scripts – Object Based Scripting for the web. Structures – Functions – Arrays – Objects.

UNIT II

DYNAMIC HTML: Introduction – Object refers, Collectors all and Children. Dynamic style, Dynamic position, frames, navigator, Event Model – On check – On load – Onerror – Mouse rel – Form process – Event Bubblers – Filters – Transport with the Filter – Creating Images – Adding shadows – Creating Gradients – Creating Motion with Blur – Data Binding – Simple Data Binding – Moving with a record set – Sorting table data – Binding of an Image and table.

UNIT III

MULTIMEDIA : Audio and video speech synthesis and recognition - Electronic Commerce – E-Business Model – E- Marketing – Online Payments and Security – Web Servers – HTTP request types – System Architecture – Client Side Scripting and Server side Scripting – Accessing Web servers – IIS – Apache web server.

UNIT IV

DATABASE- ASP – XML

Database, Relational Database model – Overview, SQL – ASP – Working of ASP – Objects – File System Objects – Session tracking and cookies
 – ADO – Access a Database from ASP – Server side Active-X Components – Web Resources
 – XML – Structure in Data – Name spaces – DTD – Vocabularies – DOM methods.

UNIT V

SERVLETS AND JSP : Introduction – Servlet Overview Architecture

– Handling HTTP Request – Get and post request – redirecting request
 – multi-tier applications – JSP – Overview – Objects – scripting – Standard Actions – Directives.

TEXT BOOK:

1. Deitel & Deitel, Goldberg, “Internet and world wide web – How to Program”, Pearson Education Asia, 2001.

REFERENCES:

1. Eric Ladd, Jim O’ Donnel, “Using HTML 4, XML and JAVA”, Prentice Hall of India – QUE, 1999.
2. Aferganatel, “Web Programming: Desktop Management”, PHI, 2004.
3. Rajkamal, “Web Technology”, Tata McGraw-Hill, 2001.

I Year I Semester	MAP ANALYSIS & PHOTOGRAMMETRY LAB and SATELLITE IMAGE INTERPRETATION LAB	L	P	C
		0	3	2

A. Map Analysis

1. Maps – types of maps; maps scales; topographic maps – numbering system of topographic maps of India and adjacent countries series.
2. Contours; Topographic profiles – simple, superimposed and projected profiles.
3. River Profiles.
4. Drainage morphometry.
5. Identification of surface features from topographic maps

Photogrammetry

1. Familiarization with pocket, mirror and prism stereoscopes.
2. Marginal Information of aerial photograph
3. Orientation of stereo model and marking principle points and conjugate Principal points, fiducial axes and flight line.
4. Computing photo scale using known objects.
5. Computing photo scale using a map of known scale.
6. Computing photo scale using focal length and altitude.
7. Height measurement
 - (i) Monoscopic measurement
 - (ii) Stereoscopic measurement
8. Slope measurement

B. SATELLITE IMAGE INTERPRETATION LAB

1. Study of SOI Topographical Maps and Satellite Image
2. Preparation of Base Maps and interpretation
3. Preparation of Slope Maps and interpretation
4. Preparation of Drainage Maps & Watershed Maps and interpretation
5. Preparation of Land Use/Land Cover Maps and interpretation
6. Referencing system of various resource satellite images
7. Marginal information of satellites images
8. Constructing spectral reflectance curves.
9. Interpretation of Thermal images

I Year II Semester	GEODESY and GNSS	L	P	C
		4	0	3

UNIT -I

Basics: Definition – Fundamental goals of Geodesy – Basic concepts

- Historical perspective – Development applications in Satellite Geodesy
- Geoid and Ellipsoid - satellite orbital motion – Keplerian motion – Kepler's Law – Perturbing forces – Geodetic satellite. Coordinate systems in Geodesy.

UNIT -II

Satellite System: GPS - Different segments – Space, control and user segments – Satellite configuration – GPS signal structure – Orbit determination and Orbit representation, Anti spoofing and Selective availability – Task of control segment – GPS receivers – Main receiver components .

UNIT -III

Surveying with GPS: Introduction, Planning a GPS Survey, Surveying Procedure. GPS observable – Code and carrier phase observation – Linear combination and derived observable

UNIT -IV

GPS Data Processing:: Point Positioning, Different Positioning & Relative Positioning, Data Processing, Ambiguity Resolution, Adjustment Filtering & Smoothing, Network Adjustment, Dilution of Precision & Accuracy Measures, **Differential GPS, Accuracy.**

UNIT- V

Applications of Satellite Geodesy: Geodetic control surveys, Cadastral surveying, Photogrammetry & Remote Sensing, Engineering application and Monitoring – GIS, GLONASS satellite configuration comparison – Satellite Laser Ranging & Applications – Concepts of satellite altimetry, Introduction to GALILEO, GAGAN.

REFERENCES:

1. Hofmann W.B, Lichtenegger. H, Collins. J Global Positioning System – Theory and Practice – Springer Verlag Wein, New York
2. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
3. Guocheng Xu GPS Theory, Algorithms and Applications, Springer – Verlag, Berlin, 2003.
4. Seeber G. Satellite Geodesy, Walter De Gruyter, Berlin, 1998.

I Year II Semester	INTERNET GEOGRAPHICAL INFORMATION SYSTEMS	L	P	C
		4	0	3

UNIT -I

Introduction to distributed internet GIS: Introduction, Distributed GIS

– Basic components, Applications of distributed GIS.

UNIT- II

Introduction to Networking: Network environments protocols, TCP/ IP, LAN, WAN, Data exchange b/w 2 terminals.

UNIT -III

Client/server computing : Client, server, glue, client-server system partition, 2-tier, 3-tier & n-tier architectures, advantages & disadvantages of client-server architecture, DCOM and .NET, DCOM Architecture and Interface, Advantages & disadvantages of DCOM, CORBA, CORBA Architecture and Interface, advantages & disadvantages CORBA.

UNIT- IV

Web mapping: Static map publishing, clickable maps, architecture of static web publishing, web mapping architecture Client-HTML viewer, HTTP server with CGI, Map server & other server, side applications.

UNIT- V

Geographic Markup Language: Principle-characteristics-commercial web mapping programs- **Open source** Internet GIS Applications, **Database Connectivity, Development of Transportation, Tourism, Natural Resource Application.**

TEXT BOOK:

1. Internet GIS – “Distributed Geographic Information Services For Internet And Wireless Networks” , Zhong-ren peng , Ming- Hsiang Tsou

I Year II Semester	ADVANCED REMOTE SENSING	L	P	C
		4	0	3

UNIT -I

FUNDAMENTALS AND RADIOMETRY: Introduction, plane waves, antenna systems, radiometry, microwave interaction with atmosphere constituents, Earth's surface and vegetation and **sensors**

UNIT- II

RADAR REMOTE SENSING: Radar interaction with Earth surface and vegetation, Surface scattering theory. Radar equation, Fading concept, Measurement and discrimination, Geometry of Radar images, Radar return and image signature. Resolution concept.

UNIT -III

REAL AND SYNTHETIC APERTURE RADARS : Airborne, Space-borne , different platforms and sensors, Data products and selection procedure, SEASAT, SIRA, SIRB, ERS , JERS, RADARSAT missions and emission Radiometric systems, Sensors, Data product and applications.

UNIT IV

Interpretation of Microwave Data: Physical Mechanism and empirical models for scattering and emission, volume scattering and emission, volume scattering. Geological interpretation of RADAR, Applications in Forestry, land use, and other disciplines.

UNIT -V

Application of radar remote sensing: Application in Agriculture, **Soils**, Forestry, Geology, Hydrology, ice studies, land use, mapping and ocean related studies.

References:

1. Ulaby, F.T., Moore, R.K. AND Fung, A.K., "Microwave Remote Sensing Active and Passive", Vol. 1,2 and 3, Addison – Wesley Publication Company, 2001.
2. Floyd. M. Handerson and Anthony, J. Lewis, "Principles and Application of Imaging Radar, Manual of Remote Sensing", 3rd edition Vol.2 ASPRS, Jhumurley and Sons, 1998.

Test Books:

1. Jenson
2. Joseph

I Year II Semester	GIS ANALYSIS & APPLICATIONS	L	P	C
		4	0	3

UNIT-I

Natural Resource Management Applications: Forestry: Resource Inventory, Forest Fire Growth modeling - Land: Land use Planning, Watershed Management studies – Water - Identification of Ground Water Recharge - Resource Information System.

UNIT -II:

Disaster Management & Facility Management Applications: Disaster management: Use of GIS in Risk Assessment, Mitigation, Preparedness, Response and Recovery phases of Disaster Management – Utilities – Water utility applications – Electric Utility Application – Telecommunication: Tower Spotting, Route optimization for meter reading for utilities – Other utilities.

UNIT- III

Location Based Services Applications: Vehicle Tracking: Automatic Vehicle Location (AVL) - Components of AVL: In Vehicle Equipment, Various Communication Channel, Web Server, Client - Vehicle Tracking - Alarms used in Vehicle Tracking, Fleet Management - Vehicle Navigation - Emergency Call: Address Geocoding, Distress Call Application.

UNIT -IV

Land Information System & Web GIS Applications: Land Information System(LIS) - Tax mapping - Other LIS applications - Web GIS: Architecture of Web GIS, Map Server, Web GIS Applications.

UNIT- V

Business, Health and Other Applications: Business Applications: Sitting a new Facility, Customer Loyalty studies, Market Penetration studies - Health applications: Disease Surveillance, Health Information System - Crime Mapping: Mapping Crime data, Hot Spot Analysis - 3D GIS.

REFERENCES:

1. Managing Natural Resources with GIS, Laura Lang, ESRI Press, 1998.
2. GIS Tools for Water, Wastewater and Stormwater Systems, Uzair M.Shamsi, U.M.Shamsi, Asce Press, 2002.
3. Introduction to Geographic Information Systems for Public Health, 1/e, Alan L., MD Melnick, Aspen Publishers, 2002.

4. Telegeoinformatics: Location-based Computing and Services, Amim Hammad, Hassan karimi, CRC Press, ,2004.
5. Geographical Information Systems, Volume I and II, Paul A Longley, Michael F Goodchild, David J Maguire, David W Rhind, John Wiley,1999
6. GIS and Remote Sensing Techniques in Land-And-Water_Management, Van Dijk M.G.Bos, Kluwer Academic Publishers, 2001
7. GIS for Health Organizations, Laura Lang, ESRI Press, 2000
8. GIS in Telecommunications Management, Lisa Godin, ESRI Press, 2001.

I Year II Semester	REMOTE SENSING AND GIS FOR NATURAL RESOURCE MANAGEMENT	L	P	C
		4	0	3

UNIT- I

Land Use/Land Cover: concepts – classification: USGS, NRSA - land use mapping –Case studies. Agriculture: crop assessment, disease detection, Crops identification and crop inventorying – Crop acreage estimation - Vegetation indices – Yield modeling – Crop production forecasting through digital analysis – Crop condition assessment – Command area monitoring – case studies

UNIT- II

Soils : soil mapping - soil moisture – soil erosion – reservoir sanitation
– soil salinity / alkalinity– soil conservation, erosion studies – Application of RS and GIS in assessing soil salinity, erosion productivity, Soils mapping using RS data – Problem soil identification and mapping – Soil sedimentation and erosion – Soil loss assessment
– Soil conservation – Case studies.

UNIT -III

Water Resources: surface water resources – water quality monitoring and mapping – water pollution, identification of ground water potential and recharge areas – integrated watershed development – case studies. Snow cover Mapping, Forecasting snow melt runoff, Glacier Mapping

UNIT -IV

Natural Vegetation: Forests – classification (NRSA) – grasslands – Forest type and density mapping using RS techniques – Forest stock mapping – Factors for degradation of forests – Delineation of degraded forests – Forest change detection and monitoring – Forest fire mapping and damage assessment – LIDAR remote sensing for forest studies.

UNIT- V

Wastelands & Coastal Resource: Types – identification – management
– eroded lands – types - layer creation – case studies. Introduction – Major issues/problem – Thematic maps on coastal resources – Wetland classification - creation of Coastal zone – Coastal Regulation zone – Coastal aquifer modeling using GIS – Integrated coastal zone management using Remote sensing and GIS - case studies

REFERENCES

1. American Society of Photogrammetry, (1983). Manual of Remote Sensing (2nd edition), ASP, Fall church, Virginia.
2. Arthor Cracknel and Landson Hayes (Editors), [1991]. Remote Sensing year Book 1987, Published by Taylor and Francis Ltd., London .
3. Pete Bettinger and Michael G Wing. Geographic Information Systems: Applications in Forestry and Natural Resources Management. McGraw-Hill Higher Education, 2003
4. Barett, E.C.,[1990] Satellite Remote Sensing for Hydrology and Water Management, Garden and Breach Science Pub lications, Switzerland.
5. Buiter, H.J., and Jan G.P.W. Clevers, [1999].Land Observation by Remote Sensing, Taylor and Francis, 1999, London.
6. Lillisand T.M. and Kiefer, P.W., (1998). Remote Sensing and Image Interpretation, John Wiley & Sons, New York.
7. Moffit, H.F., and Edward, M.M., (1980). Photogrammetry, Harper and Row Publishers, New York.
8. Skidmore, A., and Hendrik Prins (Editors),[2002] Environmental Modelling with GIS and Remote Sensing, Taylor and Francis Ltd., 2 nd Edition, London.
9. Wolf. P.R., (1974). Elements of Photogrammetry, McGraw Hill books Co., London.

WEBSITES [ww2010.atmos.uiuc.edu/\(Gh\)/guides/rs/sat/home.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/rs/sat/home.rxml)

[ww2010.atmos.uiuc.edu/\(Gh\)/guides/rs/sat/goes/home.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/rs/sat/goes/home.rxml)

www.ccrs.nrcan.gc.ca/ccrs/misc/issues/hazards_e.html#spills

www.crisp.nus.edu.sg/~research/research/forest/forest.html

www.cr.usgs.gov/earthshots/slow/tableofontents

www.indiana.edu/~climate/336/rsdata.html

www.nrsa.gov.in/engnrnsa./spacesolutions/index.html

www.unn.ac.uk/~evgpl/eog/rsguide/rsguide.htm

[www. terraweb.wr.](http://www.terraweb.wr)

I Year II Semester		L	P	C
		4	0	3

REMOTE SENSING AND GIS FOR DISASTER MANAGEMENT

Elective-II

UNIT- I Introduction to Disasters

Geological Disasters: Meaning and types of disasters – earthquakes

– volcanoes – landslides – selection of variables – creation of **Base, Thematic and Infrastructure data** – space-time analysis – GIS for management plans – case studies.

UNIT -II

Hydrological Disasters: Cyclone: cyclone related parameters and effects on land and sea – damage assessment. topography, land use and flooding – space-time integration GIS based parameters and layers – flood prone area analysis and management – **Vulnerability, Hazard, Meteorological Hydrological**- risk assessment – case studies for cyclones and floods.

UNIT -III

Climatological Disasters : Types of droughts – factors influencing droughts – variable identification – vegetation index – land use /ground water level changes – delimiting drought prone areas

– processes of desertification – over utilization of water and land resources layer creation – GIS based management strategies – case studies.

UNIT -IV

Anthropogenic Disasters Marine Disasters: Atmospheric Disasters: Ozone layer depletion – green house / global warming – acid rain – snow melt – sea level rise – related problems layer creation – oil spill and chemical pollution – coastal erosion and deposition – variable identification – over lays – analysis / management strategies – coral / mangrove depletion- case studies. **DSS Tools- (Decision Support System)**

UNIT -V

Biodiversity Disasters: Ecological degradation – nuclear disaster and biodiversity loss – parameters (mapping of forest types, protected areas and natural forests) – population extinction – conserving bio-diversity (species and subspecies) role of GIS in mapping and modeling of biodiversity

REFERENCES:

1. Korte ,The GIS book: 5/e, , G. B., Onward Press, Australia,2001.
2. Barett, E.C., Anton Micallef (Editors) Remote Sensing for Hazard Monitoring and Disaster Assessment, Taylor and Francis, London,1991.
3. M. Anji Reddy, Remote Sensing and Geographical Information Systems.,2/e, , BSP, 2001.
4. Demers, Michael N.,John Willey Fundamentals of Geographic Information Systems, ,New York,2000.
5. John A. Matthews, Bill McGuire, Ian Mason, Natural hazards and environmental change 2002.
6. Andrew Skeil Environmental Modeling with GIS and Remote sensing, , John Willey , New York,2002.
7. John. G. Lyon GIS for Water Resource and water Shed Management, , Taylor and Francis,2003.

DATA WAREHOUSING AND DATA MINING

UNIT-I

Introduction: What is Data Mining, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining. **Data Preprocessing:** Needs Preprocessing, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

UNIT-II

Data Warehouse and OLAP Technology: What is Data Warehouse, A Multidimensional Data Model, Data Warehouse Architecture and Implementation, from Data Warehousing to Data Mining.

Data mining primitives, Languages, and System Architectures- Data Mining Primitives, Data Mining Query languages, Designing Graphical user interface based on a Data mining query language, Architectures of Data Mining Systems.

UNIT-III

Concepts Description: Characterization and Comparison- Data Generalization and Summarization – Based characterization, Analytical characterization, Mining Class comparisons: Discriminating between different Classes, Mining Descriptive Statistical Measures in Large Databases.

Mining Association Rules in Large Databases - Association Rule Mining, Mining Single – Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, from Association Mining to Correlation.

UNIT –IV

Classification and Prediction – Issues regarding Classification and prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.

Cluster Analysis: Introduction, Types of Data in Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, density-Based Methods, Grid Based Methods, Model Based Clustering Methods, Outlier Analysis

UNIT—V

Mining Complex Types of Data - Multidimensional Analysis and Descriptive Mining of Complex, Data objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time-Series and Sequence Data, Mining Text Databases, Mining the WWW.

TEXT BOOKS:

1. Jiaweihan & Micheline Kamber, “Data Mining: Concepts and Techniques”, Harcourt India, Elsevier India, Second Edition.
2. Pang-NingTan. Michael Steinback,Vipin Kumar, “Introduction to Data Mining”, Pearson Education, 2008.
3. Data Mining Techniques – Arun K Pujari, University Press
4. Building the Data Warehouse – W. H. Inmon, Wiley Dreamtech India Pvt. Ltd.

REFERENCES:

- 1) Margaret H Dunham, S. Sridhar, “Data mining: Introductory and Advanced Topics”, Pearson Education, 2008.
- 2) Humphires, Hawkins, Dy, “Data Warehousing: Architecture and Implementation”, Pearson Education, 2009.
- 3) Anahory, Murray, “Data Warehousing in the Real World”, PearsonEçiuication, 2008.
- 4) Kargupta, Joshi,etc., “Data Mining: Next Generation Challenges and Future Directions” Prentice Hall of India Pvt. Ltd, 2007.

ADVANCED SURVEYING AND CARTOGRAPHY

UNIT I

Advanced Surveying: Electronic Distance Measurement (EDM) – principle, instrument characteristics, accessories, operation, EDM without reflecting prisms; Total Station – types, instrument description, field techniques, motorized total stations; field procedures for total stations in topographic surveys.

UNIT II

Topographical Surveying: Definition, uses of topographical maps, relief, methods of representing relief, contour and contour interval, characteristics of a contour, procedure in topographic surveying, Methods of locating contours, Interpolation of contours, DAM Surveys.
Generation of Digital Elevation Model(DEM)

UNIT III

Managing data bases: Data organisation – Data compression – Data measurement – Basic statistical processing –Geographic information system

UNIT IV

Data processing : Computer system for the processing of graphic data – Hardware –Software – SICAD – Digitising of cartographic presentation – Structuring and storage of data – Cartographic data processing – Output of cartographic presentation – Examples and applications.

UNIT V:

Modelling in digital cartography : Fundamentals of modelling, graph theory, topology – Digital planimetric modelling – Digital relief modelling
– Quality of digital landscape models – Topographic model generalisation, Map revision– Web Cartography – Dynamic and Static Web Maps, **Mobile Cartography**.

TEXT BOOKS:

1. Text Book of Plane Surveying By David Clark Part I and Part II
2. Text Book of Surveying By Punmia Part I and Part II
3. Menno, Jan Kraak and Ferjan Ormeling, “Cartography – Visualization of Geo spatial Data”, 2nd Edition, Pearson Education, 2004.
4. Arthur. H. Robinson et al “Elements of Cartography”, 7th Edition, John Wiley and sons,2004.

REFERENCES:

1. R.W. Anson and F.J. Ormeling, “Basic Cartography for Students and Technicians”
2. Vol. I, II and III, 2nd Edition, Elsevier Applied Science Publishers, 2002.
3. Menno, Jan Kraak and Allan Brown, “Web Cartography Developments and Prospects,
4. Taylor and Francis, 2001.
5. Surveying and Leveling – Agor
6. Principles of Cartography – K.S.Singh
7. Estimation & Costing – N.D.Chakraborti

DIGITAL PHOTOGRAMMETRY

UNIT -1

Digital Photogrammetry: definition and scope; Comparison of Analog, Analytical and Digital; Introduction to Analytical Photogrammetry – Image measurements, Control points, Collinearity condition, Coplanarity condition, Space resection by collinearity, Space intersection by collinearity, Analytical Stereo model, Analytical Interior Orientation, Analytical Relative Orientation, Analytical Absolute Orientation, Analytical Self-calibration.

Sources of Digital data: Photographs and images; Analog to Digital conversion, Scanners, Linear array line scanner – use of CCD scanners in high resolution satellites, SPOT, MOMS, IRS 1C / 1D, IKONOS, Quickbird and Cartosat-1. High Resolution satellite characteristics – Geometric and Radiometric

UNIT – 2

3-D surface modeling: DEMs, DSMs and DTMs – definitions; Vertical & Horizontal Datum, Projection and Coordinate systems

Principles of Softcopy Photogrammetry – System Hardware, Image measurements, Orientation procedures, Epipolar geometry, Digital image matching, Automatic production of digital elevation model and Orthophotos. DEM generation: Triangulated irregular networks; Gridded surfaces; Digital Photogrammetric workstations

UNIT – 3

Photogrammetric Processing: Ground Control for Aerial Photogrammetry & Aerotriangulation – Traditional field survey methods of establishing horizontal & vertical controls. Ground control surveys by GPS, Pass Points for Aerotriangulation, Sequential construction of Strip model from Independent models, Independent model Aerotriangulation by simultaneous Transformations, Bundle Adjustment, Bundle Adjustment by GPS control, Triangulation with Satellite images, Computational strategies for triangulation.

UNIT – 4

DEM Quality assessment- Vertical & Horizontal Accuracy, Factors influencing quality of DEM, Post Spacing, Quality improvement: DEM Editing

DEM User Requirements – Accuracy and Cost Considerations – Technology-based cost comparisons, Area-based cost comparisons, and Accuracy-based cost comparisons.

UNIT – 5

Photogrammetric Applications in GIS – Hazardous Waste Management, Water Quality Management, Wild Life Management, Environmental Restoration, Land Development, Transportation, Hydrography, Multi purpose Land Information System.

TEXT BOOKS

1. Paul R Wolf and Bon A. Dewitt, Elements of Photogrammetry (3ed), Mc Graw Hill
2. David F. Maune. Digital Elevation Model Technologies and Applications: The DEM User Manual. The American Society of Photogrammetry and Remote Sensing, Bethesda, Maryland
3. Eilifried Linder, Digital Photogrammetry, Theory & Application, Springer
– Verlag, Berlin, 2003 Michel Kasse & Yves Egles, Digital Photogrammetry, Taylor & Francies, London Newyork, 2001.
4. Leica Photogrammetry Suite – LPS 2011 User Manuals

GEO-STATISTICAL METHODS

UNIT- I

Terminology: Mean, Mode, Median, Std. Dev, Covariance Variance, Binomial, Poisson and Normal distributions - Definitions, with case study

UNIT -II

Principle of Least Squares, Fitting of straight line and parabola - Correlation - Karl Pearson's coefficient of correlation and Spearmann's rank correlation - Linear regression.

UNIT -III

Sampling Distributions - Tests based on Normal, t, Chi-Square and F-Distributions, Interpolation, Extrapolation methods, IDW, Kriging, Co-leriging.

UNIT -IV

One way and Two way classification of ANOVA - Completely Randomised Design - Randomised Block Design - Latin square Design.

UNIT -V

Single and multiple server markovian queueing models - M/M/1 and M/M/c queueing models and Applications.

REFERENCE BOOKS

1. Gupta, S.C., and Kapoor, V.K., Fundamentals of mathematical statistics, Sultan Chand and sons, Reprint 20032. Gupta, S.C., and Kapoor, V.K., Fundamentals of Applied statistics, Sultan Chand and sons, 20033.
Veerarajan.T., Probability Statistics and Random processes, TMH, First reprint, 2004

I Year II Semester	DIGITAL IMAGE PROCESSING LABORATORY & GIS &GPS LABORATORY	L	P	C
		0	3	2

A. DIGITAL IMAGE PROCESSING LABORATORY

1. Reading and Displaying satellite data from BIL, BSQ and BIP format
2. Generation of False Color Composite (FCC)
3. Extracting area of Interest
4. Generating Histogram of various bands
5. Geo referencing the base image
6. Geometric correction of satellite image
7. Enhancement using Band ratio and NDVI
8. Enhancement using different Filtering techniques
9. Principal Component Analysis (PCA)
10. Fourier Analysis
11. Unsupervised Classification
12. Supervised Classification
13. Classification using Neural Network and Fuzzy Logic
14. Change detection study
15. Accuracy Assessment

A. GIS &GPS LABORATORY

1. Campus survey by GPS
2. Software and hardware needs of GPS
3. Collecting ground control points (GCPs)
4. Digitization- Point, Line, Polygon and Surface Data
5. Building topology-measuring distance and area
6. Adding attribute data- querying on attribute data
7. On screen digitization-Data Conversion-Vector to Raster, Raster to Vector
8. Generation of DEM: from contours, spot heights, Arc Hydro
9. Vector Analysis-Buffering, Overlay and Network analysis
10. Raster Analysis-Measurement-Arithmetic overlaying, Logical overlaying