# ACADEMIC REGULATIONS & COURSE STRUCTURE

# For

# REMOTE SENSING

*(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 | Principales of Photogrammetry | 4 | - | 3 |
| 2 | Principles of Remote Sensing | 4 | - | 3 |
| 3 | Principles of Geographical Information Systems | 4 | - | 3 |
| 4 | Earth Systems | 4 | - | 3 |
| 5 | Object Oriented programming through JAVA | 4 | - | 3 |
| 6 | **Elective – I**<br>I. Data Base Management Systems<br>II. Principles of Geo-data base<br>III. Web Technologies | 4 | - | 3 |
| 7 | Map Analysis & Photogrammetry Lab & Satellite Image Interpretation Lab | - | 3 | 2 |
| **Total Credits** | | | | **20** |

## II Semester

| S. No. | Subject | L | P | Credits |
|---|---|---|---|---|
| 1 | Digital Image Processing | 4 | - | 3 |
| 2 | Advanced Remote Sensing | 4 | - | 3 |
| 3 | Internet GIS | 4 | - | 3 |
| 4 | R.S. & GIS Applications In Earth Sciences | 4 | - | 3 |
| 5 | **Geodesy & GNSS** | 4 | - | 3 |
| 6 | **Elective – II**<br>I. Remote Sensing & GIS for Disaster Management<br>II. Data Warehousing &Data Mining<br>III. Advanced surveying and cartography<br>IV. Advanced Photogrammetry<br>V. Geo-statistical Methods | 4 | - | 3 |
| 7 | Digital Image Processing Lab & GIS & GPS Lab | - | 3 | 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 |
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**(Common for M.TECH. SIT, RS)**

**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 Horizonal 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
4. Photogrammetry- Vol I by Krauss, J., - Springler – Verlag Publications

5. Photogrammetry 3rd Edition by Moffitt, Francis H. & Mikhail, Edward M., - Harper and Row Publishers.HH
6. Photogrammetry 3rd Edition by Moffitt, Francis H. & Mikhail, Edward M., - Harper and Row Publishers.HH

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| I Year I Semester | PRINCIPLES OF REMOTE SENSING | L | P | C |
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**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**

**Satellites Platforms 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, SeaSat, RADARSAT, RISAT, ASTER, SRTM, NOAA and Other recent satellites.

**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.

**UNIT – V**

**Hyperspectral Remote Sensing** -

Spectroscopy, Image cube, AVIRIS, Spectral matching, Data Libraries, Application of Hyperspsectral 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 Company, 2001.
6. Manual of Remote Sensing", 3rd edition Vol.2 ASPRS, Jhumurley and Sons, 1998.

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| I Year I Semester | PRINCIPLES OF GEOGRAPHICAL INFORMATION SYSTEMS | L | P | C |
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**UNIT – I**
**INTRODUCTION TO GIS SPATIAL ANALYSIS**
Components of GIS, GI Systems, Hardware and Software requirements,
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**
**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 Entitles 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, External Databases, Spatial and Non-spatial analysis – Queries, presentations 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,

**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 Estates Geographic Information System- An Introductory , Pretence 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. Menno, Jan Kraak and Ferjan Ormeling, "Cartography – Visualization of Geo spatial 4. Data", 2nd Edition, Pearson Education, 2004.

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| I Year I Semester | EARTH SYSTEMS | L | P | C |
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**UNIT – I**

Scope: earth surface forms and processes – geomorphology; atmospheric components and systems; Oceans dynamics and circulation patterns

Fundamental concepts in geomorphology; Endogenetic processes: volcanism and tectonism; Exogenetic processes: weathering, Masswasting and erosion; geomorphic agents.

**UNIT – II**

Fluvial processes and landforms: valleys and valley forming processes - associated features; Alluvium – active and relict alluvium; Floodplain morphology; Types of streams - Genetic classification of streams; Alluvial fans and deltas

Shore Zone processes and landforms: shore line, shore zone and coast; Wind waves, tides, littoral currents, storm surges and tsunamis; Erosional and depositional landforms.

**UNIT – III**

Glacial processes and landforms: ice and glaciers; types of glaciers; glacial motion; Regimen of glaciers – nourishment and wastage of glaciers; active, passive and dead glaciers; erosional and depositional landforms.

Eolian processes and landforms; dominance of wind processes in arid and semi-arid regions; erosional and depositional landforms

**UNIT – IV**

Atmosphere: Composition and Vertical Structure; Insolation and Heat Budget; Atmosphere Pressure and winds: variations of air pressure and weather – diurnal and seasonal; Wind: Factors affecting wind direction and speed, wind observation and measurement; wind shift, General circulation of the atmosphere; Atmospheric humidity, clouds and precipitation and monsoons; Air masses, fronts, weather disturbances – storms, tornadoes and their impact on life and property.

**UNIT – V**

The World Oceans; Physical properties of sea water – salinity, density, temperature, pressure, colour; Ocean dynamics: Waves – wind waves, tsunamis; Tides – diurnal semi-diurnal; Currents – longshore currents; Ocean currents – cold and warm currents and ocean circulation patterns Sea level changes – episodic, seasonal and long-terms changes and their impacts; Predicted sea-level rise: causes and consequences

**TEXTBOOKS:**

1. Geomorphology by A.L. Bloom, Waveland Pr.Inc. 2004
2. Principles of Geomorphology by W.D. Thornbury, Wiley Eastern, 1984
3. Landscape Systems by T.L. McKnight, Pretice-Hall International, 1987
4. Fundamentals of Geomorphology by R. Huggett, Routledge, 2007
5. Climatology, Lal, D.S., Sharda Pustak Bhawan, 11, University road, Allahabad, 2003
6. General climatology, Howard J. Critchfield, Prentice-Hall of India private Limited, New Delhi, 1987
7. Physical Geography, Tikka, R.N., Kedar Nath Ram Nath &Co, Meerut, 2006
8. Descriptive Physical Oceanography, Reddy, M.P.M., Oxford & IBH Publishing Co. 2001

9. Oceanography – A Brief Introduction, Siddhartha, K., Kisalaya Publications, 2004
10. Beaches and Coasts, C.A.M. King, Edward Arnold, 1961
11. Earth's Cryosphere and Sea level Change, Bengtsson et al., Springer,
2011

**REFERENCE:**

1. Sea-level rise and coastal vulnerability - an assessment of Andhra Pradesh Coast through remote sensing and GIS, Nageswara Rao et al., 2008,
2. Journal of Coastal Conservation, Vol. 12 (4), pp. 195-207

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| I Year I Semester | OBJECT ORIENTED PROGRAMMING THROUGH JAVA | L | P | C |
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**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 in Natural Resource Applications.

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.

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| I Year I Semester | | L | P | C |
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**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 ER
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 – Cursors, 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- Timestamp-Based 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.

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## PRINCIPLES OF GEODATA BASE
## ELECTIVE - I

**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: ArcGeodatabase – 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

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# WEB TECHNOLOGY
## ELECTIVE - I

**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 – Onenor – 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.

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| I Year I Semester | MAP ANALYSIS & PHOTOGRAMMETRY LAB & SATELLITE IMAGE INTERPRETATION LAB | L | P | C |
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## A. MAP ANALYSIS & PHOTOGRAMMETRY LAB

### 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

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| I Year II Semester | DIGITAL IMAGE PROCESSING | L | P | C |
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**UNIT – I**

Introduction - Image processing display systems. Initial statistical extraction - 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 – The histogram and its significance- ENTROPY and its significance - Univariate & multivariable Image statistics - 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 sites – 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.

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| I Year II Semester | ADVANCED REMOTE SENSING | L | P | C |
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**UNIT – I**

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

**UNIT – II**

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

**UNIT – III**

**REAL AND SYNTHETIC APERTURE RADARS :** Airborne, Spaceborne, 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.

**TEXT BOOKS:**

1. John R.Jenson, "Introductory Digital Image Processing", Prentice Hall Series, 1996.
1. George Joseph,(2005) Fundamentals of Remote sensing 2nd edition , University press, Pvt, Ltd, Hyderabad

**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.

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| I Year II Semester | INTERNET GIS | L | P | C |
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**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, Deployment of Transportation, Tourists, Natural Resource Applications.

**TEXT BOOK**

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

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| I Year II Semester | REMOTE SENSING AND GIS APPLICATIONS IN EARTH SCIENCES | L | P | C |
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**UNIT – I**

**LITHOLOGY AND STRUCTURE:** Introduction Rocks and Minerals image characters of igneous sedimentary and metamorphic rocks. Lithological mapping using aerial and satellite data – Structural Geology introduction Mapping structural features such as folds Lineaments / faults fractures image characters of folds faults lineaments etc. – Digital techniques for lithological and structural analysis – case studies.

**UNIT – II**

**SPECTRA OF ROCKS AND MINERALS:** Spectral properties of geologic features in different regions of Electromagnetic Spectrum Elemental composition and nature of the spectra of rocks and minerals Optimal spectral windows – Geologic Remote Sensing and its significance in Geologic mapping – case studies.

**UNIT – III**

**GEOMORPHOLOGICAL APPLICATIONS:** Introduction – Geomorphic processes and Geomorphic Landforms Geomorphic mapping using aerial photographs and satellite data – Landform analysis in Ground water studies coastal zone management and Civil Engineering projects – case studies.

**UNIT – IV**

**REMOTE SENSING AND GIS APPLICATIONS:** Thematic presentation of Lithologic structural and Geomorphic details ground truth data. Integration of all relevant data using Remote Sensing and GIS in ground water studies.

**UNIT – V**

**CASE STUDIES ON RS & GIS APPLICATIONS :** Disaster Management, Overview on Natural and Technological disasters, Applications like Landslides, Droughts and Floods, Cyclones, Forest fires, Engineering Geology, Mineral exploration and Petroleum exploration.

**REFERENCES**


1. Sabins, F., 'Remote Sensing principles and interpretation' W.H. Freeman and Company, 1987.
2. Parbin Singh, 'Engineering and General Geology', Ketson Publication House, 1987.
3. Drury, S.A., Image interpretation in Geology , Chapman and Hall, 1993.
4. Michael N. Demers, "Fundamentals of GIS", John Wiley and Sons, 1999
5. Resources Management and Environmental Monitoring - Manual of Remote Sensing", 3rd Edition, Vol.4, American Society of Photogrammetry and Remote Sensing/John Wiley and Sons, 2004.
6. Pete Bettinger and Michael G Wing. "Geographic Information Systems: Applications in Forestry and Natural Resources Management",
McGraw-Hill Higher Education, 2003.
7. Roy, P.S.,'Geoinformatics for Tropical Ecosystems', Asian Association of Remote Sensing, 2003.
8. Singh, R.P. and Vinod Tare. 'Spatial Technologies for Natural Hazards Management'. Proceedings of ISRS National Symposium, November 21–22 IIT, Kanpur. ISRS Publications, , 2000.

| I Year II Semester | GEODESY &GNSS | L | P | C |
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**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:** 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, Satellite Laser Ranging & Applications – Concepts of satellite altimetry, Introduction to GALILEO, GAGAN.

**TEXT BOOKS:**

1.
2.

**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 | | L | P | C |
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**REMOTE SENSING AND GIS FOR DISASTER MANAGEMENT**
**(ELECTIVE II)**

**UNIT – I**
**Geological Disasters**: Introduction to Disasters, use of GIS in risk assessment, mitigation, preparedness, response and recovery phases in disaster management, types of disasters – earthquakes – volcanoes – landslides – selection of variables – creation of base data, thematic data, infrastructure – 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, hazards, risk – risk assessment – case studies for cyclones and floods.

**UNIT – III**
**Climatological Disasters :**
Types of droughts: Meteorological, Hydrological – 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 – DSS - over lays – analysis / management strategies – coral / mangrove depletion-case studies.

**UNIT – V**
**Biodiversity Disasters**: Ecological degradation – nuclear disaster and biodiversity loss – parameters (mapping of forest types, protected areas and natural forests) – population extinction – conserving biodiversity (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 WAREHOSUING AND MINING**
**(ELECTIVE II)**

**UNIT – I**

**Introduction:** What is Data Mining, Data Mining Functionalities, Classification of Data Mining Systems, MajorIssues in Data Mining.

**Data Preprocessing:** Needs reprocessing, 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, A 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. MichaelSteinback,VipinKumar, “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", Pearson Education, 2008.

4) Kargupta, Joshi, etc., "Data Mining: Next Generation Challenges and Future Directions" Prentice Hall of India Pvt Ltd, 2007.

# ADVANCED SURVEYING AND CARTOGRAPHY
# (ELECTIVE II)

**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 Models (DEM)

**UNIT – III**

**Managing data bases:** Data organisation – Data compression – Data measurement – Basic statistical processing –Geographic information system – The measuring of GIS to cartography.

**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.

**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 4. Data”, 2nd Edition, Pearson Education, 2004.
5. Arthur. H. Robinson etal “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,

## ADVANCED PHOTOGRAMMETRY
## (ELECTIVE II)

**UNIT – I**

History and development, principles, classification; Aerial Cameras - Basic optics photographic process and Imaging System. oblique, title and terrestrial Photogrammetry.

**UNIT – II**

The concepts, tools, viewing and measuring systems of sterocope. The image Geometry and object coordinates, scale, displacement. Characteristics, scale, measurement, tilt effects, rectification, overlap, stereopair.

**UNIT – III**

Concepts of Interior, relative and absolute orientation. The image correlation, linearisation, scaling & leveling, analytical procedures, 3D Information and mapping.

**UNIT – IV**

Basics of Planimetric mapping, radial line triangulation. Aerial mosaics, types of control points. The concepts of overlap, floating mark parallax equation, height information.

**UNIT – V**

Elements of Aerotriangulation and analytical method, strip deformation, strip and block adjustment: Automated system, image correlation, matching and orientation, mapping and Information extraction. The project information; project planning, photo control, planning, cost estimate

**REFERENCE BOOKS**

1. Wolf Paul. P., “Elements of Photogrammetry”, McGraw Hill International Book Company, 2nd editiion, 1983
2. Francies H. Moffit and Mikail, Edward M., “Photogrammetry”, Harper and Row Publi - shers, 3rd edition, 1980
3. Karl Krans, “Photogrammetry, Vol I & Vol II”, Ferd DGmmler verlag, 4th edition 1997 American Society of Photogrammetry, 4th edition, 1980

## GEO-STATISTICAL METHODS
## (ELECTIVE II)

**UNIT – I**

Terminology, Binomial, Poisson and Normal distributions - Definitions,

**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, Chi-Square and F-Distributions, Intrapolation & Extrapolation methods, IDW, Kriging, co-kriging

**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.,
2. Fundamentals of Applied statistics, Sultan Chand and sons, 20033. 3. Veerarajan.T., Probability Statistics and Random processes, TMH, First
reprint, 2004

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| I Year II Semester | DIGITAL IMAGE PROCESSING LABORATORY & GIS & GPS LABORATORY | L | P | C |
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**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

**B. 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