Post Graduate Diploma in Geoinformatics (Duration:01 years)

Number of subjects in each semester

1. The Diploma course will be 2 Semester duration each covering a period of 6 months.
2. First Semester will have 4 theory papers and 2 laboratory classes / practical, of six months of duration and second semester will have five theory papers of six months duration with two practical papers.
3. Each subject will be of theory classes of 60 minutes duration with a credit of 2.0.
4. Each laboratory class will be of 2:30 hour duration with a credit of 1.0.
5. The total credit for both (02) semesters will be 2x4= 8 for theory classes and 01x2=02 for lab classes, i.e. a total of 10 credits in first semester 12 in second semester and a project work of 3 credits.
6. The second Semester will be of 15 credits. The student will have to carry out Project work of 3 credits in this Semester and have to submit a project report at the end of the Semester. A student has also to appear for a Grand Viva-voce at the end of 2nd. Semester based on the project work.

Marks and examinations

1. In each Semester there will be 3 class tests(internal examination) of 20 marks, the best score of two class tests marks out of a maximum marks of 20+20=40 scored by a student will be counted for addition to the end semester theory paper marks of 80. The internal should account for 20 marks only.
2. Students will be required to give a seminar presentation at the end of a semester with a report write up on any topics assigned to them. The topic will be assigned by the class teacher on the respective theory topic. The maximum marks for this presentation is 20 and is to be substituted by the third internal examination.
3. The total mark for a theory paper will be 100 i.e. 80 for end Semester written examination + 20 for class test.
4. Each laboratory / practical paper will carry maximum marks of 50.
5. The maximum marks for each paper will be 100 for theory and 50 for practical.
6. The marks will be converted in to a 10 point grade as per the following rules.

Theory paper			Practical		
Marks	Grade	Grade point	Marks	Grade	Grade point
90% and above	O	10	90% and above	O	10
80% to 89%	A	9	80% to 89%	A	9
70% to 79%	B	8	70% to 79%	B	8
60% to 69%	C	7	60% to 69%	C	7
50% to 59%	D	6	50% to 59%	D	6
35% to 49%	P	5	35% to 49%	P	5
Below 35%	F	0	Below 35%	F	0

P stands for pass

7. A student has to score a minimum of 5 Semester Grade Point Average (SGPA) and pass in all subjects, both theory and practical in order to qualify for the next semester.
8. A student failing (Grade F) in one or more theory papers in a semester but securing a minimum of 5 SGPA will have to clear the paper in which the student has failed by reappearing in a separate test(s) on payment of additional fees of Rs. 500 per paper failed for which the tests will be carried out by the respective subject teacher.
9. A student has to pass the laboratory classes in one chance and no reexamination will be allowed in laboratory class.
10. Failure in more than two subjects in a semester or obtaining less than 5 SGPA in a semester even while passing in all subjects (Grade P) will debar a student to continue the course.
11. The grading system of project and viva-voce will be as that of the practical.

Post Graduate Diploma in Geoinformatics (01 year)

Calculation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

$$SGPA = \frac{\sum_{n=1}^{n=4} (\text{no. of credit in theory} \times \text{grade obtained} + \text{no. of credit in lab} \times \text{grade obtained})}{10}$$

$$CGPA = \frac{\sum_{i=1}^{i=4} ((\text{SGPA of i th. Semester} \times \text{no. of credits of i th Semester})}{40}$$

In order to be eligible for the Diploma in Geographical Information Systems, Remote Sensing & Geocomputations a student has to pass in all subjects, both theory and practical as well as project and viva-voce and secure a CGPA of 5.0.

Subjects in each Semester

First Semester

Sl. Code Subject & Credit

1. PGDGI T001 Principles of Remote Sensing - (2-0)
2. PGDGI T002 Cartography & Geo-Statistics – (2-0)
4. PGDGI T003 Geo-Sciences & Image Interpretation – (2-0)
5. PGDGI T004 Introduction to Calculus, Vectors, Matrices & Computer Programming (2-0)

6. PGDGI P 001 Geo-science & Image Interpretation Lab(1-0)
7. PGDGI P 002 GIS lab (1-0)

Second Semester

Sl. Code Subject & Credit

1. PGDGI T 005 Geographical Information Systems (2-0)
2. PGDGI T 006 Digital Image Processing – (2-0)
3. PGDGI T 007 Spatial Data Modelling & Advanced GIS – (2-0)
4. PGDGI T 008 Global Positioning Systems & Differential Global Positioning Systems (GPS & DGPS)– (2-0)
5. PGDGI T009 Special Paper

6. PGDGI P003 SDM & AGIS Lab (2-0)
7. PGDGI P004 DIP Lab (2-0)
8. PGDGI P005 Special paper Lab (2-0)

{Specializations Offered in: Geoinformatics in Water Resource Management, Geoinformatics in Urban & regional Planning, Web GIS}

Sessions & Classes

1. The academic session will start from 2nd week of August or as advertised at the time of seeking the applications and will be over in the 2nd. Week of following June.

2. The theory classes will be from 9-00 AM to 12:30PM (11.00 – 12.00, 12.10 – 01.10, 01.15 – 2.00) and the lab class will be held from 1:30 pm to 4:30pm or as and when opted by the institute administration.

3. If it is required the concerned faculty of a relevant discipline may schedule extra classes as per the requirement for the successful accomplishment of the course with due permission from the concerned authorities.

4. Administrator (AITER) is the only responsible authority to deal up with the internship of the students, placement and allied aspects. Only best candidates will be absorbed by Prantik Care the Earth in its

ventures. Principal, AITER is directly responsible to Administrator, AITER and President cum Director, PCTE in submission of weekly reports as well as other proceedings in time with 100 % honesty and accuracy.

5. The details of the classes, time schedule for the examination as well as other pros and cons are to be placed up in the institute notice board on timely fashion with due permission from Principal, AITER.

SYLLABUS

1. PGDGI T 001 Principles of Remote Sensing - (2-0)

Unit I: Fundamentals of Remote Sensing

Definition of Remote sensing, Advantages and limitations, Remote sensing process & Stages, Electromagnetic Radiation (EMR): EMR Spectrum and its properties, EMR wavelength regions and their applications, Atmospheric windows, Interaction of EMR with matter, Spectral signatures, Resolutions: Spectral, Spatial, Temporal and Radiometric

Unit II: Aerial Photography

Fundamentals of aerial photography, Vertical and Oblique aerial photography, Aerial cameras, Photogrammetry; Basic concepts of scale, object height and length, object area and perimeter, grayscale tone/color of objects, Photo interpretation techniques, Stereo Photogrammetry and stereovision, Parallax bar and its applications.

Unit III: **Platforms & Sensors**
Photographic System: Cameras, Sensor classification: Active and Passive, along track and across track scanners, Infrared Scanners, Thermal Sensors and Microwave Sensors

Unit IV: **Thermal & Microwave Remote Sensing**
Introduction to Thermal Infrared Radiation Properties: Kinetic Heat, Temperature, Radiant Energy and Flux, methods of transferring heat, Thermal properties of terrain: Thermal Capacity, Thermal conductivity, Thermal Inertia, Thermal Infrared Multispectral scanners, Thermal IR Remote sensing examples

Passive Microwave Sensors, Active Microwave Sensors, Side looking RADAR, Scatterometer, Orbits of satellite, Keppler"s laws of motion, IRS Series of Satellites, LANDSAT, SPOT, IKONOS, QUICKBIRD, MODIS, RADARSAT, NOAA, TERRA, MOS and ERS, Brief introduction to Weather and Communication Satellites

Unit V: Remote Sensing of Environment & Hyper-Spectral Remote Sensing

Spectral Signature and its Response: of Soil, Vegetation and Water, Basics of visual interpretation of satellite images

Hyper-spectral remote sensing

TEXT BOOKS:

1. Jensen, J.R., "Remote Sensing of the Environment – An Earth Resources Perspective", Pearson Education,
Inc. (Singapore) Pvt. Ltd., Indian edition, Delhi, 2000
2. George Joseph, "Fundamentals of remote sensing", Universities press (India) Pte Ltd., Hyderabad, 2003

REFERENCE BOOKS

1. Sabins, F.F. Jr., „Remote Sensing – Principles and Interpretation", W.H. Freeman & Co., 2002 Edition.
2. Reeves, Robert G., "Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA
3. Lillesand, Thomas M. and Kiefer, Ralph, W., "Remote Sensing and Image Interpretation", 4th Edition,

John Wiley and Sons, New York, 2000
4. Rampal, K.K., Handbook of Aerial Photography and Interpretation, Concept Publishing Company, New Delhi, 1999

2. PGDGI T 002 Cartography & Geo-Statistics – (2-0)

Unit I:
Basic Concept of cartography, Categories of maps, Interpretation of topographic maps, Cartographic databases, data measurement, cartographic design issues, colour and pattern, map lettering, map compilation, map scale, Generalization, symbolization, dot, isopleth and choropleth mapping, multivariate and dynamic mapping, map production, methods of map composing and printing,

Unit II:
Basic Assumptions of projection system, Map Projections, Grouping of map projections: conic projection, cylindrical projection, Zenithal, Projection Types: Mercator, Transverse Mercator, Polyconic, Lambert, Orthomorphic, UTM Projections and their comparison, choosing a Map Projection, Map Projection transformation, Analysis and visualization of distortion

Unit III:
Visualization of geospatial data: Design aspects, Multiscale and geometric aspects scale, dissemination of (visualized) geospatial data, data products, use and users of products, Various issues in map visualization., Computer Cartography, the nature of Data, Database and Data structures, Data Input: Method of data capture, digitization and scanning method, Techniques and procedure for digitizing, Vector and Raster; Data output: Screen display system, file organization and formats, rectification of digital maps, software for digital mapping.

Unit IV:

Statistics: Basic Concepts; Graphical representation of Statistical Data., Measures of central tendency & Dispersion (mean, median, mode, standard deviation), kurtosis & Skeweness, Regression analysis (multiple, logistic), trend surface analysis, spatial auto correlation, quadrant analysis, weighted mean, sampling (random, systematic and stratified), standard error measurement, Probability, correlation coefficient, variance, covariance, Basic Matrix algebra, Kriging; Trend Analysis.

REFERENCE BOOKS

1. Keates, J.S. (1973): Cartographic Design and production, London, Longman
2. Ramesh, P. A. (2000): Fundamentals of Cartography, Concept Publishing Co., New Delhi.
3. Rampal, K.K. (1993): Mapping and Compilation, Concept Publishing Co.,New Delhi.
4. Anson, R.W. & Ormeling, F.J. (1993), Basic Cartography, Vol. 1, 2nd ed., Elsevier Applied Science, Publishers, London.
5. Robinson A.H. & Morrison J.L, (1995) Elements of Cartography, John Wiley & Sons
6. Gregory, S. (1978): Statistical Methods for Geographers, Longman
7. Singh, R.L & Dutt. P.K, "Elements of Practical geography", Students Friends Allahabad
8. Peterson, M.P. (1995) "Interactive and Animated Cartography" Upper Sadde River, NJ: Prentice Hall.

3. PGDGI T 003: Geo-Sciences & Image Interpretation

UNIT 1: GEO SCIENCE & IMAGE INTERPRETATION

- Visual and Digital Satellite Image Interpretation
- Elements of Image Interpretation
- Development of Interpretation Keys
- Concepts of terrain mapping using image interpretation
- Rock Types, their field characteristics; delineation on satellite imagery, Mineral deposits & their Characteristics.
- Drainage pattern, their texture and their characteristics; delineation on satellite data.
- Terrain types and their image characteristics: Arid, Coastal, Fluvial, Volcanic, Glacial, Peri-glacial.

UNIT 2: VISUALIZATION

- Visualization of 2D and 3D data
- Rendering of three dimensional data in virtual GIS environment
- Visualization of 3D vector graphics

UNIT 3: GEOINFORMATICS FOR ENVIRONMENTAL ANALYSIS AND MANAGEMENT

- Geoinformatics for Environmental Pollution & EIA studies
- Space Technology for Environmental Management: Introduction, Challenges and opportunities (Administrative, Socio-economic, Political)
- Environmental Data base creation (Global, Regional, Local) (Topographic Data; Soil Resource Information; Hydrological Data; Oceanographic Data; Large Area Land Cover Characterization; Biodiversity Data and Information)

UNIT 4: APPLICATION AREAS

- Biodiversity management and characterization
- Watershed management for soil and water conservation planning
- Urban resource planning- an integrated approach
- Integrated coastal zone management
- Disaster management (Basic Concepts, Geological: landslides, Coal Mines hazards etc., Hydro-meteorological: floods & droughts. Forest Fire etc.)
- Application of Geoinformatics in Mineral and ground water exploration.
- Land degradation and desertification
- Engineering Geology Application.

ESSENTIAL READING

- Murk & Skinner, (1999). Geology Today - Understanding Our Planet, John Wiley And Sons Inc, New York
- Lillisand, T. M. and Keifer, R. W., (2007). Remote Sensing and Image Interpretation', John Willey and Sons, New York, Fourth Edition
- Jenson, J.R., (2006). Remote Sensing of the Environment – An Earth Resource Perspective, Prentice Hall Inc.
- Drury, S.A. , (2004). Image Interpretation in Geology, Chapman & Hall, India.
- Sabins, Floyd F., (2007). Remote Sensing and Principles of Image Interpretation, 2nd Ed., Freeman, New York.

4. PGDGI 105 Fundamentals of Calculus, Vectors, Matrices & Computer Programming (2-0)

Unit I: Algebra & Trigonometry

Formula from plane elementary algebra and geometry and trigonometry, elements of variables, continuous variables, functions and limits, principle of differentiation, derivative as rate of change, derivative of a function of one variable, general rule for differentiation, interpretation of derivative by geometry, rules for differentiation, differentiation of a sum, differentiation of product and function, power rules, differentiation of inverse function, various applications of derivatives, tangent and normal, maximum and minimum values of a function, successive differentiation, curvature of a circle, formula for curvature, rectangular coordinates.

Unit II: Calculus

Constant of integration, indefinite integral, Rules for integrating standard elementary forms, constant of integration, geometrical significance of constant of integration, Definite integral, calculation of areas, volumes, integration as a process of summation, ordinary differential equation and solution

Unit III: Vectors & Matrices

Matrices, and determinants, properties of matrices, evaluation of determinants, product, sum and differences of matrices, adjoint and inverse of a matrix, linear homogeneous equations and solutions, eigen values and eigen vectors. Vectors and scalars cross and dot product of vectors, addition and subtraction of vectors

Unit IV: Computer Programming

Introduction to Computers: Essential PC hardware, peripherals and software, Data storage and manipulation Computer configurations including PCs, terminals & workstations for networks to serve large and small businesses Introduction to Networks: Star and Bus LAN topologies; Central and distributed computing; Wide area and global networks; The World Wide Web. Introduction to Algorithms: Definition of Program & Algorithm; I/O functions, Pseudocode, Flowchart, Implementation of algorithms Data types, constants, variables and arrays, declarations, expressions, statements, Control Statements, symbolic constants Operators and Expressions, Arithmetic operators, unary operators, relational, logical and bitwise operators, assignment operators Functions: defining a function, accessing a function, passing arguments to a function, specifying argument data types, function prototypes, recursion, call by value, call by reference. Arrays and Pointers: Defining an array, processing an array, passing array to a function, multidimensional arrays, arrays and strings, pointer declarations, passing pointer to a function, pointer and one dimensional array, Operation on pointers, pointers and multidimensional arrays.
Introduction to databases, characteristics of the database approach, database users and designers, role of a DBA Advantages of using a DBMS, data models, schemas, instances, DBMS architecture (Three-Schema Architecture) Conceptual Data Modeling: Phases of database design, entity type, entity set, attributes, keys, value sets, relationships, relationship types, relationship sets, relationship instances, relationship degree, role names, recursive relationships, constraints on relationship types, attributes of relationship types, weak entity types, ER Diagram, naming conventions and design issues.

REFERENCE BOOKS:

- SCHAUM series books of calculus, vectors, statistics and matrices
- Byron S. Gottfried, *Theory and Problems of Programming with C*, Tata McGraw Hill Publication
- R.Elmasri, S.B Navathe, *Fundamentals of Database Systems*, Addision, Wesley
- Computer Processing of Remote Sensed Images, Paul M. Mather, John Wiley & Soins, 1987
- Alvi, Z 1995, *Statistical Geography-methods and applications*, Rawat Publications, New Delhi
- King,L.J., *Statistical Analysis in Geography*, Prentice –Hall,1969
- Lafore,Robert.*Object-Oriented Programming in C++* Dorling Kindersley(India) Pvt. Ltd.,2002

Post Graduate Diploma in Geoinformatics (01 year)

PGDGI P 001 Geo-Sciences & Image Interpretation Lab

- Exercise 1 Study of a satellite image – annotation (IRS-1B, IRS-1C etc.)
- Exercise 2 Visual interpretation and separation of physical and cultural features
- Exercise 3 Identification and comparison of objects on panchromatic, multiband and FCC
- Exercise 4 Interpretation and delineation of satellite image for landuse/landcover
- Exercise 5 Interpretation of Thermal Image
- Exercise 6 Interpretation of microwave image
- Exercise 7 Field visit and comparison of ground details with details on image
- Exercise 8 Visualization and rendering of 3D data- Arc Scene /ERDAS Virtual GIS/ Google Earth
- Exercise 9 Draping of satellite data in Arc Scene
- Exercise 10 satellite based interpretation of Glaciated, Aeolian and plain landforms

PGDGI P 002 Cartography, Geo-Statistics & Computer Programming Lab – (0-1)

- Construction of different types of scales
- Construction of different types of map projection: Conical projection, Cylindrical Projection, WGS 84
- Preparation of UTM grid
- Base Map
- Designing and Symbolization
- Analog to Digital Conversion
- Analysis of Toposheet
  Updation of maps from Satellite Imagery.
- Introduction to computers & programming concept
- Programming using concepts of variables, operators
- Programming using control structures
- Programming using functions and arrays
- Programming using strings
- Programming using data structure
- Programming using file handling
- Creation of forms and using control variables
- Creating menus in forms
- Connecting with database
- Adding maps in VB Projects
- Adding database of maps in the projects

5. PGDGI T 005 Geographical Information Systems (2-0)

UNIT 1: INTRODUCTION

- Basic concepts: Definition and history
- Components of GIS,
- Data structure and formats
- Spatial data models – Raster and Vector
- Data base design - editing and topology creation in GIS, Linkage between spatial and non spatial data
- Data inputting in GIS

UNIT 2: RASTER AND VECTOR DATA ANALYSIS

- Integration of Raster & Vector Data
- Cartographic Modeling - Map Algebra
- Raster Data & its Representation: Types, Data Structure, Data Compression, Data Files, Data Conversions
- Raster Data Analysis – Overlay Operations, Slope & Aspects, Statistical Analysis
- Geometric Transformations - Affine Transformation and Geometric Transformation Coefficients, RMS Error
- Vector data representation: Topological & Non-topological Vector Data, Map scale, Spatial Resolution, Spatial Data Accuracy, Location Data Accuracy and Precision, Vector Data Sources
- Comparison between Raster & Vector Data
- Feature Based Topological functions: Buffering Overlay Analysis, Distance Measurements
- Layer Based Topological Functions

UNIT 3: DATA EXPLORATION & DATA INTEGRATION

- Interactive Data Exploration, Vector Data Query, Attribute Data Query
- Logical Expressions, Types of Operations
- Relational Database Query: Use of SQL, Descriptive Statistics of Attribute Data
- Spatial Data Query, Raster Data Query, Query by Cell Value, Query using Graphical Methods, Charts
- Geographic Visualization, Data Classification, Spatial Aggregation, Map Comparison
- Problem Identification & Designing a Data Model

UNIT 4: APPLICATONS OF GIS

- Application of GIS Techniques in Various Fields
- Web GIS

ESSENTIAL READING

- Burrough, Peter A. and Rachael McDonnell,(1998), „ Principles of Geographical Information Systems" Oxford University Press, New York.
- C.P.L and Albert K.W.Yeung (2006) "Concepts and Techniques of Geographic Information Systems" Prentice Hall of India,New Delhi.
- Demers, Michael N. 2000. *Fundamentals of Geographic Information Systems*. John Wiley, Singapore.
- ESRI 1993. *Understanding GIS.* Redlands, USA
- George, Joseph 2003. *Fundamentals of Remote Sensing*. Universities Press (Pvt.) Ltd, Hyderabad.
- Girard, M-C. and Girard, C. M. 2003. *Processing of Remote Sensing Data*. Oxford & IBH, New Delhi.
- Heywood, Ian 2003. *An Introduction to Geographical Information Systems*. 2nd ed. Pearson Publ. Co., Singapore.
- Kang-tsung Chang (2007),„Introduction to Geographic Information Systems" Tata McGraw Hill, New Delhi.
- Longley, P., Goodchild, M.F., Maguire, D. and Rhind, D. 1999. *Geographic Information Systems. Principles, Techniques, Management, Applications*. John Wiley, New York.
- Magwire, D. J., Goodchild, M.F. and Rhind, D. M., (2005),„Geographical Information Systems: Principles and Applications', Longman Group, U.K.
- Martin, D. 1996. *Geographic Information Systems: Socioeconomic Implications*. Routledge, London.

.

PGDGI T 006: Digital Image Processing (DIP) (2-0)

UNIT 1: INTRODUCTION

- Concepts about digital image and its characteristics
- Spectral, Spatial, Radiometric and Temporal resolution
- Visual vs. Digital methods, Image data storage and retrieval
- Image restoration and Noise Abatement , Radiometric and Geometric correction technique
- Interpolation methods – linear and non linear transformation for geometric corrections

UNIT 2: IMAGE ENHANCEMENT & FILTERING TECHNIQUES

- Look-up Tables (LUT) and Types of image displays and FCC
- Image Enhancement Techniques: Radiometric and Spatial
- Contrast stretching: Linear and non-linear methods
- Spatial Filtering: High and Low frequency, Image smoothing

UNIT 3: MULTI-BAND ENHANCEMENT TECHNIQUES & CLASSIFICATION

- Band ratio, Types of Vegetation indices
- Principal Component Analysis
- Multi dated data analysis and Change detection
- Digital Image Classification: Supervised & Unsupervised
- Accuracy Assessment, Error Matrix

UNIT 4: PATTERN RECOGNITION

- Concept of Pattern Recognition, Multi-spectral pattern recognition
- Spectral discrimination, Signature bank, Parametric and Non-Parametric classifiers

ESSENTIAL READING

- Sabins, Floyd F. (2007), Remote Sensing: Principles and Interpretation, H. Freeman and C., New York.
- Thomas M. Lillesand & Kiefer, Ralph W. (2007), Remote Sensing and Image Interpretation, John Wiley & Sons, New York.
- Jensen, JR. (2006), Remote Sensing of the Environment- An Earth Resources Perspective, Prentice Hall Inc.
- Rencz, Andrew N. , (1999), Remote Sensing for the Earth Sciences: Manual of Remote Sensing, 3rd ed., John Wiley & Sons, Inc., New York.
- Curran, P., (1985), Principles of Remote Sensing, Longman, London.
- Campbell, James B., (2006), Introductory Remote Sensing: Principles and Concepts, Routledge.
- Gibson, P.J., (2000), Introduction to Remote Sensing, 2nd ed., Taylor & Francis, London.
- Cracknell, A.P. & Hayes, L.W B., (2007), Introduction to Remote Sensing, Taylor & Francis, London.

PGDGI T 007: SDM & AGIS (2-0)

UNIT 1: INTRODUCTION TO GIS ANALYSIS AND MODELING

- Spatial Data: Definition, Analysis, Processes & Steps, Software and Tools
- Raster-Based and Vector-Based GIS Modeling, Binary Models, Index Models, Regression Models, Process Models
- Geodatabase Model, Role of Databases in GIS, Creating, Editing and Managing

UNIT 2: SPATIAL DATA ANALYSES TECHNIQUES

- Classification Scheme of Vector-Based and Raster-Based GIS Operations
- Raster–Based Techniques: Methods of Reclassification, Overlay Analysis, Slope and Aspects, Buffering, Cost-Distance Calculation
- Vector-Based Techniques: Map Manipulation Techniques, Buffering, Overlay Analysis, Network Analysis
- Digital Terrain Analyses and Modeling: TIN and DEM, Surface Representation & Analysis

UNIT 3: GEOSTATISTICAL ANALYSIS TECHNIQUES

- Introduction to Spatial Interpolation: Control Points
- Global Methods: Trend Surface Analysis, Regression Models
- Local Methods: Thiessen Polygons, Density Estimation, Inverse Distance Weighted Interpolation
- Kriging: Ordinary Kriging (Semivariance, Semivariogram), Universal Kriging,

UNIT 4: INTRODUCTION TO DSS

- GIS and decision support system, Introduction to decision making process and decision support systems, Introduction of a frame work for planning and decision making, Spatial Decision Making
- Development of DSS, DSS Architecture
- Principles and components of multiple-criteria decision making
- Main multiple-criteria evaluation methods/techniques
- Spatial multiple criteria decision making
- Multiple-criteria decision making in spatial data analysis
- Introduction to AHP, Basic Principles of AHP
- Effect Table, Pair Wise comparison, Standardization, Consistency, Weightage, performance score, Different method in PWC

UNIT 5: CASE STUDIES USING AHP, ANN, LOGISTIC REGRESSION MODEL, SLEUTH MODEL

- Case Study of Landslide Vulnerability Assessment/Ground water potential mapping using AHP analysis tool
- Case Study of Urban Modelling using SLEUTH modelling
- Case of Landslide/GLOF using ANN analysis
- Logistic Regression Modelling based assessment of natural hazards in a mountainous urban topography.

References/Suggested Readings:

- Bonczek, R.H., C.W. Holsapple, and A.B. Whinston, (1981), Foundations of Decision Support Systems, Academic Press, New York. Basic text on DSS
- Geoffrion, A.M., (1983). "Can OR/MS evolve fast enough? Interfaces 13:10. Source for six essential characteristics of DSS

- House, W.C. (ed.), (1983). Decision Support Systems, Petrocelli, New York. Basic DSS text
- Sprague, R.H., (1997). "A framework for the development of decision support systems, "Management Information Sciences Quarterly 4:1-26. Source for DSS development model
- Sprague, R.H., and Carlson, E.D., (1982). Building Effective Decision Support Systems, Prentice-Hall, Englewood Cliffs NJ. Basic DSS text
- Burrough, Peter A. and Rachael McDonnell., (1998), Principles of Geographical Information Systems. Oxford University Press, New York
- Laurini, Robert and Derek Thompson. , (1992), Fundamentals of Spatial Information Systems. Academic Pr., London
- Kluwer Fotheringham A S, O'Kelly M E., (1998), Spatial Interaction Models: Formulations and Applications.
- Paul Longley, Michael Goodchild, David Maguire and David Rhind:, (2005), Geographical Information Systems. Principles, Techniques, Applications and Management. John Wiley & Sons.

Post Graduate Diploma in Geoinformatics (01)years

PGDGI T 008: GPS & DGPS (2-0)

Unit I

Basic principles of Geodesy; History of Geodesy; Spherical Earth; Ellipsoidal Earth; Geoidal Earth; Geodetic Survey Systems; Horizontal Positioning – Determination of Astronomic position, Triangulation, Trilateration; Vertical Positioning.

Unit II

Fundamentals of Reference Systems and Frames: Geodetic and Cartesian coordinate system; principles of coordinate transformation; Datums: Horizontal and vertical datums – national, regional and local datums; Major datums and Indian datum; World Geodetic System (WGS) WGS84; tidal datums;

Unit III

Satellite Geodesy: definition; observational systems: Historical systems; Doppler; laser; radar altimetry;

Unit IV

Global Positioning System (GPS): Definition; GPS elements – space segment, user segment and control segment; Observation principles; phase measurement techniques; determining orthometric heights; GPS Error Sources and Error Handling Procedures: Atmospheric effects, clock and orbital errors, multipath, anti-spoofing and selective availability, etc; interference and jamming. Accuracy issues, GPS satellite navigation message; GPS time, fundamental and derived frequencies.

Unit V

GPS receivers: Multi-channel, sequential and multiplexing receivers;

GPS applications: Defense, civilian, Navigational and Geodetic applications; GPS-GIS integration

GPS applications in surveying, mapping, GIS and land navigation and precision farming; integration with other sensors: GPS in intelligent transportation and fleet management

Textbook

1. Physical Geodesy by Weikko A. Heiskanen and Helmet Moritz, W.H.Freeman and Company
2. The gravity field of the Earth, International Geophysics Series- Vol-10 by Michele Caputo, Academic Press, New York.
3. Global Positioning System – Theory and Practice – Hofmann W.B, Lichtenegger. H, Collins. J – Springer Verlag Wein, New York
4. GPS: Theory and Practice, B. Hofmann-Wellenhof, H. Lichtenegger and J.Collins, 5th Revised Edition, Springer, Wien, New York, 2001.
5. GPS Satellite Surveying, A. Leick, 2nd edition, John Wiley & Sons, 1995.
6. GPS: Theory and applications, B. Parkinson, J. Spilker, Jr. (Eds), Vol. I & II, AIAA, 370 L'Enfant Promenade SW, Washington, DC20024, 1996.
7. GPS for Geodesy, A. Kleusberg and P. Teunnisen (Eds), Springer-Verlag, 1996.
8. Surveying, F. Moffitt and J. Bossler, 10th edition, Addison Wesley Longman, Inc., 1998, Chapter 10: The Global Positioning System, pp. 349-368 (optional).

Post Graduate Diploma in Geoinformatics (01)years

PGDGI P 003: SDM & AGIS Lab (0-1)

Exercise 1	a) Introduction to Arc GIS software and overview of Map digitization and Map composition. b) Spatial and Non Spatial data collection, representation and standardization
Exercise 2	a) Graphical Representation of Spatial data (Raster/Vector Method). b) Data Organization (location, attributes, consistency, scale)
Exercise 3	a) Raster Geo-referencing; b) Vector Geo-referencing in ArcGIS & Arc Info software
Exercise 4	Spatial Data Analysis (Raster & Vector), data Linkage for Analysis
Exercise 5	Topology Creation; Map Algebra
Exercise 6	a) Simple & Complex Relational Data Base Query b) Network Analysis.
Exercise 7	a) Open source GIS demo- GRASS GIS b) Open source GIS demo- Q-GIS
Exercise 8	Open source GIS demo- Post GIS
Exercise 9	Creating conceptual models - Site Suitability Model
Exercise 10	Advanced Editing of geographically referenced data
Exercise 11	Geocoding
Exercise 12	Representing features in Raster data
Exercise 13	Creating TIN surface from vector/
Exercise 14	Monitoring of forest fires using
Exercise 15	MCDM

PGDGI P 004: Digital Image Processing Lab (0-1)

Exercise 1	Import / Export of files using DIP Software (ERDAS IMAGINE)
Exercise 2	Geo-reference of the Toposheet and imageries
Exercise 3	Sub-setting of area of interest, Image Mosaic, Interpretation and Analysis of Imageries
Exercise 4	Performing contrast enhancement techniques, Filtration: High, Low frequency
Exercise 5	Principal Component Analysis
Exercise 6	Classification: Supervised
Exercise 7	Classification: Unsupervised
Exercise 8	Map composition

Post Graduate Diploma in Geoinformatics (01)years

DGIST T 009: Special paper(2-0)

Geoinformatics in Disaster Management (2-0)

UNIT 1: INTRODUCTION

- Hazards and disasters, their types, and characterization
- Zonation of hazards, natural and human induced disasters
- Disaster and National losses, historical perspective of disasters in India.
- Fundamental concept of Disaster Management
- Government, NGOs and peoples participation disaster management
- Existing organization structure for managing disasters in India
- Geoinformatics in disaster mitigation.

UNIT 2: HAZARDS

- Landslide, Earthquake
- Mining hazards (Land subsidence, Mine flooding etc.)
- Volcanic hazards, Groundwater hazards, Glacial hazards
- Flash floods, River floods
- Dam burst, Cloud burst
- Cyclones, Coastal hazards and Drought
- Forest hazards (Deforestation, Degradation and Forest fire)
- Land & soil degradation, Desertification
- Pollution (Water, air and soil)

UNIT 3: GEOINFORMATICS APPLICATIONS:

- Geoinformatics models in managing forest fires, floods, landslides, cyclone and earthquake mapping.

UNIT 4: CASE STUDIES

- Earthquakes in India
- Floods in Indo Gangetic plains
- Landslides in Himalayan region
- Drought in Indian plateau regions

ESSENTIAL READING

- P.S. Roy (2000) Natural Disaster and their mitigation. Published by Indian Institute of Remote Sensing.
- Sdidmore A (2002) Environmental Modeling with GIS & Remote Sensing, Taylor & Francis.
- Anji Reddy. M. (2004) Geoinformatics for Environmental Management. B. S. Publication.

or

Post Graduate Diploma in Geoinformatics (01)years

Geoinformatics in Water Resource Management

UNIT 1: BASIC CONCEPT

- Hydrologic Cycle, hydrological parameters,
- Watershed characterization, delineation and codification
- Watershed problems and management strategy
- Geoinformatics approach for watershed prioritization
- Drainage Morphometric Analysis

UNIT 2: REMOTE SENSING IN SURFACE-SUBSURFACE WATER EXPLORATION

- Application of remote sensing in hydrogeomorphological interpretation for ground water exploration
- Water quality monitoring through remote sensing
- Geophysical Methods for Groundwater Exploration.

UNIT 3: OPERATIONAL APPLICATIONS IN WATER RESOURCES

- Flood Prediction, Drought Evaluation
- Snow Cover Mapping
- Reservoir Sedimentation Evaluation.
- Geoinformatics **B**ased Runoff & Hydrological Modeling
- Flood Hazards Modeling, Snowmelt Runoff Modeling.

UNIT 4: CASE STUDIES

- Hydrogeomorphological Mapping in Plateau Region
- Flood Prone Zone Mapping in Indo Gangetic Plains
- Water Harvesting Initiatives in Urban Built Up Lands
- Drought Assessment in Jharkhand.

ESSENTIAL READING

- Schultz, G. A. and Engman, E. T. , (2000), Remote Sensing in Hydrology and Water Management, Springer-Verlag, Berlin, Germany.
- Murthy, J. V. S. (1994). Watershed Management in India. Wiley Eastern Ltd., New Delhi.
- Todd David Keith., (2005), Groundwater Hydrology, John Wiley & Sons, New York, Second Edition.
- Schultz, G.A. & Engman, E.T. ,(2000), Remote Sensing in hydrology and water management, Springer-Verlang, Berlin, Germany.

or

Geoinformatics in Urban & Regional Planning

UNIT 1: BASIC CONCEPTS

- Importance & Relevance of Remote Sensing data for Urban and Regional Planning
- Visual and Digital Data Analysis Techniques
- Scale and Resolution concepts
- Scope and Limitations of Remote Sensing Application to Urban and Regional Planning.

UNIT 2: REGIONAL AND URBAN PLANNING

- Urban and Regional Mapping
- Base Map Preparation, Regional, City, Intra –City,

- Scale & Methodology
- Urban and Regional Plan Formulation
- Theories of Urban growth/Urbanization
- Application of Remote Sensing Techniques in Regional Plan, Master Plan,

UNIT 3: URBAN ANALYSIS

- Urban Analysis, Urban Growth
- Trend Analysis, Change Detection
- Slum Development, Housing Typology and Density Analysis, Population Estimation
- Information system
- Database Organization- Large Scale Data Entry
- Interpretation Manipulation- Retrieval- Attribute Information for Urban Planning

UNIT 4: CASE STUDIES

- Analysis of Urban Land Use Change
- Preparation of Master Plan in City Development
- Object-oriented GIS Data Modelling for Urban Design
- Delineation of socio-infrastructure database into GIS for land use planning
- Urban Growth, Planning and Development in five selected major towns in World: Newyork, Paris, London, New Delhi & Beijing

ESSENTIAL READING

- Arnoff, S (1989); Geographical Information Systems: A Management Perspective, WDL Publications, Canada
- Brench M.C. (1972), City planning and Aerial Information, Harvard University, Cambridge
- Burrough, P.A (1988), Principles of Geographical Information Systems for land Resources Assessment, Oxford University Press
- Subudhi A.P, Sokhi, Roy (2001), Remote Sensing and GIS, Application in Urban and Regional Studies, IIRS, Dehra Dun
- Subudhi, A.P (1992), Design of Automated Land Use Information System for Town & Country planning, Institute of Town planners, New Delhi,

or

Web GIS, Data Mining & Neural Networks

Unit I

Introduction to Data Mining: importance and motivation of data mining, relational databases, data warehouses and data mining, translational databases, advanced database systems and advanced database application, data mining functionalities, pattern classification of data mining systems, major issues in data mining.

Data mining primitives, definition of data mining tasks, data mining query language, designing of graphical user interface based on data mining query language and architecture of data mining systems

Unit II

Classification and Clustering, classification and prediction concepts and issues regarding classification and prediction, classification by decision tree introduction, Bayesian classification, classification by back propagation,

classification based on concepts from Association rule mining , K- nearest neighborhood classifiers, case based reasoning, genetic algorithms, roughest approach, fuzzy set approaches and prediction.

Cluster analysis: introduction to cluster analysis, types of data in cluster analysis, categorization of major clustering methods. Data mining applications: GIS and Data Mining – geospatial data mining for market intelligence; data mining for automated GIS data collection

Unit III

Introduction to web GIS, Basics of Web page, Web Mapping basics, Geo-Spatial web services, Geo-Spatial mashups, Geoportals & NSDI, Web GIS Applications, Mobile GIS, The future of web GIS

Unit IV

Neural network fundamentals: introduction to Hopfield networks, learning in neural networks, applications of neural networks, recurrent networks, distributed representations, multilayer networks and back propagation algorithm.

Unit V

Neural networks applications: neural network-based land transformation models; ANN and GIS in natural resource applications

Textbooks:

1. Introduction to Data Mining by A. Addisan Weeley Publication
2. Neural Networks and Fuzzy systems by B. Kosko, Prentice_hall India

References

1. Geospatial Data Mining for Market Intelligence by Paul Duke (http://www.tdan.com/view-articles/4921)
2. Data mining for automated GIS data collection by K-H Anders, Photogrammetric Week 01, 2001 pp 263-272 (http://www.ifp.uni-stuttgart.de/publications/phowo01/Anders.pdf)
3. Using GIS artificial Neural networks and remote sensing to model urban change in the Minneapolis-St Paul and Detroit Metropolitan areas, by B.C. Pijanowski and B.A. Shellito (http://web.ics.purdue.edu/~bpijanow/ASPRS%202001%20pijan.pdf)
4. Integration of GIS and Artificial Neural Networks for Natural Resources Applications by Gregory L. Easson, and David J. Barr (http://gis.esri.com/library/userconf/proc96/TO150/PAP126/P126.HTM)

PGDGI P 006: Special paper Lab

Geoinformatics in Water Resource Management Lab

1. **Creation of Water shed Map using satellite data**
2. **Creation of DEM using satellite Data**
3. **Creation of TIN**
4. **Creation of Hydro-Geology Map**
5. **Creation of Hydro-Geomorphology map using Satellite data**
6. **Delineation of Drainage basin and deriving out its Ground water potential**
7. **Ground water quality mapping using DSS**

8. **Creation of ground water maps in Arc GIS software**
9. **Water Contamination Mapping using satellite based techniques**

Or

Geoinformatics in Urban & Regional Planning

1) **Identification and description of objects (point features) on aerial photographs & satellite images**
2) **Identification and description of objects (linear features) in urban area on aerial photographs satellite images.**
3) **Delineation and mapping of urban land uses on aerial photographs & satellite images**
4) **Multi date mapping of urban sprawl with GIS Software**
5) **Demarcation and mapping rural-urban fringe on aerial photographs and satellite images**
6) **Preparing interpretation keys for urban area (pan, multiband-true color and FCC)**
7) **Mapping LULC transformation**
8) **Population estimation through remotely sensed data -one exercise**
9) **On screen digitization and mapping of various urban land use/ land cover on satellite images**
10) **Digital interpretation (supervised classification) of urban area on satellite images**

Or

Web GIS

1. ***Basics of Web GIS***
2. ***Creation of web Portals***
3. ***Creation of database using open source software***
4. ***Uploading of geographically referenced data in Server***
5. ***Attributing of data***
6. ***Storage, retrieval and analysis of web based geographically referenced data***