PROFESSIONAL DIPLOMA IN GEO-INFORMATICS

Course Structure

Objective:
The objective of the course is to provide theory as well as hand-on skill to students for various applications in Remote-Sensing (RS), GIS, Computer-Aided Cartography (CAC) and Computer Aided Photogrammetry training and skills towards professional digital analysis of geo-spatial data.

Course Structure:
The course shall be spread over 2 (two) semesters with weightage (contact hours) of 20 each per week. The structure of the course shall be as follows:

Examination system:

1. Sessional and End-Semester division shall be 25% and 75%.
2. Sessional shall constitute of two tests (10% each) and one presentation (5%)
3. End-Semester examination shall be working exercises, 3 out of a choice of 5 (60%) followed by viva-voce (15%) except the project papers.
4. The Projects shall be evaluated (a) Project itself (50%) + (b) Viva-voce (25%)

Evaluation :

25 percent of the credits in each course shall be evaluated on a continuous evaluation method consisting of test (at least one-10 %), assignments (at least two-15 percent).

75 percent of the credits in each course shall be evaluated on the basis of an end-term examination consisting of theory examination of one hour per credit and practical examination of 2 hours per credit.

Question paper in theory examination shall be set by the Course-instructor. External Expert shall set and evaluate Practical examination papers/components. In the event of External Experts not being available for a practical paper, an Examination Board consisting of three members (Coordinator, Course teacher and one more member) shall be appointed by the Department for conducting the examination.

25 percent sessional evaluation in project shall be done by a Board consisting of at least three members (Coordinator, Supervisor, and one more member).

End-term evaluation of the project work for 75 percent of the credit allotted to this course shall be made by an external examiner not being an employee of the University. The distribution of weightage shall be 25 percent for presentation and 25 percent for report and 25 percent for viva-voce examination.

Semester I

Course No	Course Title	Credits	Remarks
GEINFO-601	Principles of Remote Sensing & GPS	4	T-2+P-2
GEINFO-602	Fundamentals of GIS	4	T-2+P-2
GEINFO-603	Cartography & Geo Statistics	4	T-2+P-2
GEINFO-604	Geosciences & Image Interpretation	4	T-2+P-2
GEINFO-605	Computer Programming	4	T-2+P-2

Semester II

Course No	Course Title	Credits	Remarks
GEINFO-606	Digital Image Processing	4	T-2+P-2
GEINFO-607	Spatial Analysis & Modeling	4	T-2+P-2
GEINFO-608	Project	4	Practical
GEINFO-609	Geoinformatics in Agriculture, Soil & Land Evaluation	4	T-2+P-2
GEINFO-610	Geoinformatics in Regional and Urban Planning	4	T-2+P-2
GEINFO-611	Geoinformatics in Water Resources	4	T-2+P-2
GEINFO-612	Geoinformatics in Disaster Management	4	T-2+P-2

Note: Students shall have to select any two papers from Course No: GE INFO 609 to GE INFO 612.

SEMESTER-I

GE INFO 601 PRINCIPLES OF REMOTE SENSING & GPS

UNIT 1: BASIC PRINCIPLES

- Remote Sensing: History, Development, Definition, Concept & Principles
- Electromagnetic Radiation (EMR): Spectrum and its properties, Atmospheric windows, Interaction of EMR with atmosphere & Earth's Surface
- Spectral signatures & Resolutions: Spatial, Spectral, Radiometric and Temporal
- Remote Sensing Systems: Platform, types of platforms & its characteristics.
- Sensor classification: Active and Passive, Optical-Mechanical Scanners & Push-broom scanners
- Thermal Infrared: Introduction, Radiation Properties, Kinetic Heat, Temperature, Radiant Energy and Flux, methods of transferring heat
- Thermal properties of terrain: Capacity, conductivity, Inertia, Infrared,
- Microwave: Passive & Active Sensors, RADAR, Scatterometer

UNIT 2: AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY

- Introduction: Fundamentals of Aerial Photography: flight planning & execution Photogrammetry: Basic concepts of measurements of object height and length,
- Stereo Photogrammetry: Stereovision & Stereoscopes, Stereoscopic Parallax & Parallax Equations
- Digital photogrammetry: Model deformation & Rectification ,Relief displacement , Vertical exaggeration ,Triangulation, Control & Mapping.

UNIT 3: REMOTE SENSING SATELLITES & SPECTRAL DATA ANALYSIS

- Satellites & their characteristics – Geostationary & Sun Synchronous
- Earth Resource Satellite: (Sun Synchronous) IRS, LANDSAT, SPOT, IKONOS, QUICKBIRD, MODIS, RADARSAT, ERS, CARTOSAT etc.
- Weather & Communication Satellites: (Geostationary) NOAA, TERRA, MOS, INSAT, GOES, etc.
- Spectral Signature and its Response: Soil, Vegetation, Rocks and Water bodies etc.,
- Ground Truth Verification:
- Remote Sensing Applications: Agriculture, Forestry, Water resources , Regional and Urban Planning

UNIT 4: GLOBAL POSITIONING SYSTEM

- Fundamentals of GPS and its applications
- Geodesy
- Components of global positioning system
- Factors affecting GPS accuracy
- GPS surveying methods and accuracy
- Reference station, reference equipments and radios

LAB WORK

Exercise 1	Test of Stereo Vision, computation of photo scales, Orientation of Stereo pair
Exercise 2	Parallax bar handling and height measurements
Exercise 3	Interpretation of satellite image for landuse/landcover, urban sprawl and slope mapping
Exercise 4	Creating codes and attribute table in GPS
Exercise 5	Data collection: Measurements, Line, Area Calculation
Exercise 6	Data collection in DGPS mode.
Exercise 7	Processing of GPS data in the software

ESSENTIAL READING

- Jensen, J.R., (2006) "Remote Sensing of the Environment – An Earth Resources Perspective", Pearson Education, Inc. (Singapore) Pte. Ltd., Indian edition, Delhi.
- George Joseph, (2004) "Fundamentals of remote sensing", Universities press (India) Pte Ltd., Hyderabad.
- Sabins, F.F. Jr., (2007) Edition. 'Remote Sensing – Principles and Interpretation", W.H. Freeman & Co.
- Reeves, Robert G. (1991), "Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA
- Lillesand, Thomas M. and Kiefer, Ralph, W., (2007) "Remote Sensing and Image Interpretation", 4th Edition, John Wiley and Sons, New York
- Rampal, K.K., (1999) Handbook of Aerial Photography and Interpretation, Concept Publishing Company, New Delhi
- N.K.Agrawal , (2004) ,Essentials of GPS, Spatial Network Pvt. Ltd
- Sathish Gopi , (2000), GPS and Surveying using GPS
- Leica. A., (2003), GPS Satellite Surveying, John Wiley & Sons, use. New York
- Terry-Karen Steede, (2002), Integrating GIS and the Global Positioning System, ESRI Press

GE INFO 602 GEOGRAPHIC INFORMATION SYSTEMS

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

LAB WORK

Exercise 1	Data Organization (location, attributes, consistency, scale)
Exercise 2	Spatial and Non Spatial data collection, representation and standardization
Exercise 3	Graphical Representation of Spatial data (Raster/Vector Method)
Exercise 4	Overlay Analysis, data Linkage for Analysis
Exercise 5	Relational Data Base Query

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.
- Ralston, B. A. 2002. *Developing GIS Solutions with Map Objects and Visual Basic*. OnWord Press: Thompson Learning, New York & Singapore.
- Reddy, M. Anji 2001. *Textbook of Remote Sensing and Geographic Information Systems*. B. S. Publs., Hyderbad.

GE INFO 603 CARTOGRAPHY & GEOSTATISTICS

UNIT 1: BASIC CONCEPT OF CARTOGRAPHY

- Introduction to cartography: nature and scope
- Approximation of Earth, Introduction to Geometrics.
- Categories & Characteristics of maps, Study of different types of maps, Survey of India national series maps Interpretation of topographic maps,
- Basics of Map scales.
- Reference and coordinate system
- Indexing and Numbering of topographical maps

UNIT 2: DESIGN ISSUES

- Fundamentals of Cartographic Design, colour, pattern, lettering, compilation, border information, aesthetics
- Generalization: Semantic & Geometric, symbolization, dot, isopleth and choropleth mapping,
- Multivariate and dynamic mapping,
- Map production, methods of map printing
- Visualization of geospatial data: Design aspects, Multiscale and geometric aspects scale, dissemination of (visualized) geospatial data, Graphic Symbology & Variables.
- Data products, use and users of products
- 3D Visualization, Various issues in map visualization, Interactive Cartography

UNIT 3: DIGITAL MAPPING, DATA STRUCTURE AND LAYOUT

- Digital Cartography - Elements of digital Cartography
- Analog to Digital Conversion of Data.
- Conventional mapping VS Digital Mapping
- Nature of Data, Database and Data structures,
- Data Input: data capture, digitization and scanning,
- Digital database creation : Point features, Line features, Polygon features
- Data Editing-Removal of errors – Overshoot & Undershoot, Snapping
- Data Collection and Integration, Non-spatial data attachment working with tables
- Dissolving and Merging

UNIT 4: ELEMENTARY STATISTICS

- Data base query: Reclassification, overlay cross tabulation, editing, assigning attribute values, extraction of attribute values, histogram, area and perimeter calculation, profile generation, probability classification.
- Mathematical operations: Image overlay, scalar image operations, image attribute transformation.
- Distance operators: Distance analysis (spherical distance, cost distance), buffer analysis, direction variable cost distance, dispersion distance, least cost path analysis, spatial allocation and reallocation, Thiessen Polygon.
- Context operators: Surface analysis, filtering pattern analysis, grouping watershed, determination, hinterland determination.
- Statistics: Regression analysis (multiple, logistic, pattern analysis, trend surface analysis, spatial auto correlation, quadrant analysis, weighted mean, centre/ standard radius, compaction index, sampling (random, systematic and stratified), standard scores method.

LAB WORK

Exercise 1.	Construction of different types of scales Simple, Comparative, Diagonal Scale.
Exercise 2.	Construction of different types of map projection Conical projection , Cylindrical Projection ,Zenithal Projection
Exercise 3.	Preparation of UTM grid
Exercise 4.	Preparation of Base Map
Exercise 5.	Designing, Symbolization, Pattern and Shading techniques

ESSENTIAL READING

- Keates, J.S., (2008): Cartographic Design and production, London, Longman
- Ramesh, P. A., (2000): Fundamentals of Cartography, Concept Publishing Co., New Delhi.
- Rampal, K.K., (2004): Mapping and Compilation, Concept Publishing Co.,New Delhi.
- Anson, R.W.& Ormeling, F.J., (2008), Basic Cartography, Vol. I&II ed., Elsevier Applied Science Publishers, London.
- Robinson A.H. & Morrison J.L, (1995) Elements of Cartography, John Wiley & Sons
- Singh, R.L & Dutt. P.K,(2008), "Elements of Practical geography", Students Friends Allahabad
- Peterson, M.P., (1995) "Interactive and Animated Cartography" Upper Sadde River, NJ: Prentice Hall.
- Clark, I. (1979), Practical Geostatistics, Applied Science Publishers, London
- Davis, J.C. (1973), Statistics and Data Analysis in Geology, Wiley, New York.
- Matheron, G.F, (1963) Principles of Geostatistics: Economic Geology vol.58

- Stein, A. (1998), Spatial Statistics for Soils and the Environment, ITC lecture notes.

GE INFO 604 GEO SCIENCES & IMAGE INTERPRETATION

UNIT 1: THE EARTH SYSTEM

- Concept of Earth System, Lithosphere, Biosphere, Hydrosphere & Atmosphere
- Elements Of Photo Interpretation In Geological Studies- lithotypes and structural features

UNIT 2: IMAGE INTERPRETATION

- Visual and Digital Satellite Image Interpretation
- Elements of Image Interpretation
- Development of Interpretation Keys
- Ground Truth Verification

UNIT 3: GEOMORPHOLOGY & LANDFORMS

- Fundamental Concepts: Geomorphic Agents and Processes
- Development of Drainage Patterns and their Significance.
- Image Characteristics of Major Landforms: Fluvial, Aeolian, Glacial and Marine

UNIT 4: OPERATIONAL APPLICATIONS

- Natural Hazard Risk Management.
- Regional & Urban Planning
- Agricultural , Soil and Land Evaluation
- Water Resources

LAB WORK

Exercise 1	Tracing of Details From Stereo Pair
Exercise 2	Interpretation of Satellite Imagery in different Bands
Exercise 3	Interpretation of Thermal Image and Drawing of Isotherms
Exercise 4	Identification of different Features using TM, FCC and Thermal Imagery
Exercise 5	Identification of Cultural Details from Satellite Imagery

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
- Pandey, S. N. , (1987). Principles and Applications of Photogeology. New Delhi: Eastern Wiley.
- 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.
- Thornbury, W. D., (I969): Principles of Geomorphology, John Wiley and Sons, New York
- Sabins, Floyd F., (2007). Remote Sensing: Principles and Interpretation, 2nd Ed., Freeman, New York.

GE INFO 605 COMPUTER PROGRAMMING

Unit 1: Basics of Computer Hardware, Numerical Systems, Basic Programming

1. Introduction to Computers (10 hrs)

• Essential PC hardware, peripherals and software, Data storage and manipulation

• Computer configurations including PCs, terminals & workstations for networks to serve large and small businesses. Broad introduction to the main types of software.

Data Communications

• Introduction to Networks

• Star and Bus LAN topologies;

• Central and distributed computing;

• Wide area and global networks;

• The World Wide Web; Using the Internet and email effectively.

Unit 2. HTML Programming: (5 hrs)

HTML Elements <HEAD>,<TITLE>,<BODY>,<P>,
,<CENTER>,<DIV>,<BLOCKQUOTE>,<PRE>,<FONT>,<BASEFONT> Lists (<UL>,<OL>,<LI>), HR,Text formatting elements(<I>,<B>,<U>,<STRIKE>)

Address Element

Links and Addressing

Linking basics: HREF, NAME

Images and Anchors: <IMG>,image alignment, Plug-Ins Using <EMBED>, Scrolling with <MARQUEE>

Text Alignment, Tables and Fonts

Word Hinting <NOBR>,<WBR> Specific to Netscape <SPACER>,<MULTICOL>

Unit 3. C++ Programming: (10 hrs)

Introduction to Algorithms, C Fundamentals, I/O functions, Control Statements and C Preprocessor

Definition of Program & Algorithm, Pseudocode, Flowchart, Implementation of algorithms

C Fundamentals: The C character set, identifiers and key words, Data types, constants, variables and arrays, declarations, expressions, statements, symbolic constants, Operators and Expressions, Arithmetic operators, unary operators, relational, logical and bitwise operators, assignment operators, library functions.

I/O functions: Preliminaries, getch, getche, getchar, putch, putchar, scanf, printf, gets, puts. Control statements: Preliminaries, while, do.. while, for, if..else, switch, break, continue, goto statements. The C Preprocessor: Macro Expansions.

Functions, Storage Classes, Arrays and Pointers

Functions: A brief overview, defining a function, accessing a function, passing arguments to a function, specifying argument data types, function prototypes, recursion, call by value, call by reference.

Program Structure: Storage classes, Automatic, Register, External, Static Variables.

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 arrays, Operation on pointers, pointers and multidimensional arrays.

Unit 4. Vsual Basic Programming: (10hrs)

Creating Working Directory, Project, Forms, Module, Project window, Object, Event.

Controls & Properties : PictureBox, Label, TextBox, Frame, CommandButton, CheckBox, OptionButton, ComboBox, ListBox, HScrollBox, Timer, DriveListBox, DirListBox, FileListBox, Shape, Line, Image, Graph, Mhstate, Outline and their Corresponding Properties

Basic Programming Building Blocks : Variables, Data types, Logical testing, Arithmetic and Relational Operators, Branching with if, Select Case, GoTo, For...Next, Do Loops, While... Wend, Arrays(ReDim), On...GoSub, On...OnGoTo, InputBox, Msgbox, InputBox, String Functions like Space, Space$, Str, Str$, Len, Trim, Ltrim, Rtrim, Trim$, Mid, Mid$, Left, Left$.

Procedures: Procedures (Sub and Fun), Attaching an Event procedure to a Form or Control, Creating a General procedure.

Testing & Debugging: Errors & Watches, Error Trapping

Unit 5.Relational Database Management System (RDBMS): (8 hrs)

Introduction: 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)

C*onceptual 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.

LAB WORKS

Lab 1. Introduction to computers & programming concept

Programming in 'C' Language

Lab 2. Programming using concepts of Variables, Operators

Lab 3. Programming using Control Structures

Lab 4. Programming using Functions and Arrays

Lab 5. Programming using Strings

Lab 6. Programming using Data Structure

Lab 7. Programming using File Handling

Programming in 'C++' Language

Lab 8. Programming using concepts of Control Structure, Function & Arrays.

Lab 9. Programming using Classes

Lab 10. Programming using concept of Inheritance

Essetial Readings

Byron S. Gottfried, *Theory and Problems of Programming with C*, Tata McGraw Hill Publication

E. Balaguruswamy, *Programming in ANSI C*, Tata McGraw Hill publication

Jeffrey P. McManus, *DataBase Access with Visual Basic 6: The Authoritative Solution*, Tech Media, Sams Publishing.

Paul Sheriff's *Teaches Visual Basic,* Prentice, Hall India.
R.Elmasri, S.B Navathe, *Fundamentals of Database Systems*, Addision, Wesley

SEMESTER-II

GE INFO 606 DIGITAL IMAGE PROCESSING

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
- Accuracy Assessment, Error Matrix

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

UNIT 4: PATTERN RECOGNITION

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

LAB WORK

Exercise 1 Import / Export of files using DIP Software
Exercise 2 Geo-reference of the Toposheet and imageries
Exercise 3 Display, Analysis and interpretation of Imageries
Exercise 4 Performing contrast enhancement techniques, Filtration: High, Low frequency
Exercise 5 Sub-setting of area of interest from the satellite image
Exercise 6 Principal Component Analysis
Exercise 7 Classification: Supervised, Unsupervised
Exercise 8 Mosaic of Images
Exercise 9 Map composition

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.

GE INFO 607 SPATIAL ANALYSIS & MODELING

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, Wieghtage, performance score, Different method in PWC

LAB WORK

- Exercise 1 Creating conceptual models - Site Suitability Model.
- Exercise 2 Representing features in Raster data set
- Exercise3 Creating TIN surface from vector/ raster data,
- Exercise 4 Monitoring of forest fires using DSS
- Exercise 5 Spatial Multi Criteria decision making for site selection

ESSENTIAL READING

- 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.

GE INFO 608 PROJECT

The subject/topic of the Project Work, related to the problems will be allotted to each student in the beginning of the IInd Semester. The students, in consultation with their respective supervisors, may give their choice of preference of problem /topic / area. However, the decision of the Head/Course Coordinator shall be final. Each student will be required to work independently on the problem assigned including literature consultation, data collection, fieldwork and/or training, laboratory investigations, report writing etc., under the guidance of his/her supervisor. The students will have to submit to the department three typed (bound) copies of his/her work, in the form of Project Report. After the evaluation, a copy of which will be returned to the concerned supervisor and the student separately.

The Project topic should consist of the following:

- Problem identification and its aims and objectives,
- Review of Literature,
- Data acquisition and Collection,
- Methodology,
- Analysis and Result.

Presentation:

On satisfactory completion of the project, each student is required to defend his/her thesis through a PowerPoint presentation in front of an external expert and faculty and students which will be followed by Viva-Voce. This should be a substantial piece of research work, which both reinforces the skills learned in the taught component of the course and provides a genuine opportunity to undertake valuable research.

GE INFO 609 GEOINFORMATICS IN AGRICULTURE, SOIL & LAND EVALUATION

UNIT 1: ESTIMATION & SPECTRAL ANALYSIS OF CROPS AND DAMAGE ASSESSMENT

- Spectral Properties of Crops and Yield Parameters
- Identification of Crops and Acreage Estimation.
- Vegetation Indices
- Production Forecasting through Digital Analysis
- Monitoring, Condition, and Damage Assessment
- Detection of Pests and Diseases
- Damages due to Droughts and Floods
- Water-logging and Salinity, Stress Detection.

UNIT 2: SOIL CLASSIFICATION & MAPPING

- Soil Types in India
- Soil Survey Methods, Soil Classification
- Problems with Soil Identification
- Mapping of Soils using RS and GIS techniques.

UNIT3: LAND EVALUATION & ASSESSMENT

- Land Evaluation,
- Role of Remote Sensing in Soil Conservation.
- Principle and Methods of Land Assessment
- Agriculture and Soil Development
- RS & GIS in Land Evaluation

UNIT 4: CASE STUDIES

- GIS for Drawing out Action Plans & Recent Development in Agro- Climatic Modeling
- Watershed Planning, Remote Sensing in Agriculture & Soil studies

ESSENTIAL READING

- Steven, M.D. and Clark, J.A., 1991, Application of Remote Sensing in Agriculture, Butterworths, London
- Ghassem Asrar, 1989. Theory and application of optical remote sensing. John Wiley & Sons, New York
- Space Applications Centre- Manual of procedure for Forest mapping and Damage Detection using satellite data, Report No. IRS-UP/SAC/FMDD/TN/16/90, 1990: pp-58.
- Space Applications Centre –Status Report on Crop Acreage and Production Estimation, Report No. RSAM/SAC/CAPE/SR/ 25/90, October 1990, pp-253.
- Brockington, N.R., (1979): “Computer Modelling in Agriculture”, Oxford University Press
- Siva Vandana, (2002), “Sustainable agriculture and food security”, Sage Publications New Delhi.
- Narayan, L.R.A., (2001),: “Remote Sensing and its application”, University Press, Hyderabad.

GE INFO 610 GEOINFORMATICS IN REGIONAL AND URBAN PLANNING

UNIT 1: BASIC CONCEPT

- 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
- 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 Organisation- 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

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,

GE INFO 611-GEOINFORMATICS IN WATER RESOURCES

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.

GE INFO 612 GEOINFORMATICS IN DISASTER MANAGEMENT

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.

ON PROFESSIONAL DIPLOMA IN GEO-INFORMATICS

(Under Section 26 (1) (b) of the NEHU Act, 1973)

OC – 14

ON CERTIFICATE AND PG DIPLOMA COURSES
Under Section 26(1) (b) of NEHU Act, 1973

1.1. The University shall conduct certificate Courses of one semester duration (six months) and PG Diploma courses of two-semester duration (one year). ii. In addition, the University may prescribe Professional PG Diploma Programmes either on regular or self-financing basis which shall be of two semester duration. iii. There shall be separate regulation governing fee structure, examination system and other operational aspects for each of such professional Diploma programme.
2. The Syllabus for the courses shall be as prescribed by the Board of Post Graduate Studies of Steering Committee and approved by the School Board and Academic Council.
3. i The eligibility for admission to certificate courses may be prescribed in regulations for the purpose. ii. The eligibility for PG Diploma courses shall be a Bachelor's Degree or equivalent.
4.i. For Certificate programmes shall be a minimum requirement of 18 credits in one semester. ii. The Course structure of PG Diploma programmes shall be based on a minimum requirement of 36 credits spread over two semesters. iii. The University shall conduct the semester examinations and declaration of results for both the Certificate and PG Diploma courses.
5.i. The Course Structure and distribution of marks/credits of both Certificate and PG Diploma programmes shall be provided in the syllabus prescribed for the purpose. ii. The sessional assessment component shall be a range of 25% - 50% for the Certificate/PG Diploma course but could vary among papers depending on specific requirement of the paper. The prescribed syllabus for the course shall define the practical and theory components as well as weightage on sessional assessments. iii. Details of evaluation system for practical and sessional assessments shall be provided in the syllabi concerned.
6. The evaluation of the PG Diploma course shall be in Grading System, as prescribed for the Masters Programme (OC-7).
7. Any difficulty arising in giving effect to or interpreting any of the provisions of this Ordinance shall be referred to the vice-Chancellor whose decision thereon shall be final.

REGULATIONS ON PG DIPLOMA IN GEO-INFORMATICS
(Under NEHU Ordinance OC-14)

Title 1.	This regulation shall be called "Regulations On PG Diploma in Geo-informatics".
Duration 2.	i. The course shall be offered at the beginning of each academic year. ii. The Course shall be operated on self-financing basis.
Advisory Committee 3.	i. There shall be a Committee constituted by the HOD to oversee the functioning of the course. ii. The Committee shall have a two-year term. iii. The Committee shall meet at least once each year. iv. The Convener shall give two weeks' notice for the meeting with prior approval of the Chairperson. v. One third of total numbers will constitute the quorum for meetings. vi. The Committee shall have the following functions: a. Admission Policy and its review if any. b. Fee structure to make the course financially viable. c. Honorarium/Payments to be made to instructor from within the department and from outside, including external experts. d. Exploring placement of outgoing students. e. Reviewing quality of instructions and syllabus etc. f. Any other matter related to the course and its operationalisation, referred to by the Head of the Department of Geography.
Seats 4.	i. The number of seats shall be 20 in all for each batch. ii. Fifty percent of the seats (10) shall be reserved for candidate with geography as their main (Hons) subject. iii. Any change in number of seats shall be decided by the Committee and shall be announced by 15th March of the previous academic year.
Eligibility 5	i. Applicants with Bachelors Degree (Hons) in Geography, Geology and Earth Sciences, Life Sciences, Agricultural Sciences, Physical Sciences, Mathematics/ Statistics, Environmental Sciences, BE/BTech (Electronics/IT/Computer Sciences/Telecom) /B.Arch/B.Plan and BCA/MCA with a minimum of 60% of marks in the subject concerned or equivalent CGPA shall be eligible for admission. ii. Candidates belonging to ST/SC categories shall be eligible for relaxation of minimum percentage/CGPA to the extent of 5% in admission to the course as per Government of India policy on the matter.
Admission 6	i. Admission to the course shall be announced along with University Admission Announcement as per in Ordinance and University guidelines. ii. There shall be a written admission test conducted by the Department in July each year and the process of admission completed as per the University Calendar, OC-15.
Fees 7	i. Tution fees will be Rs.15,000.00 per semester. ii. 10% of the student shall be given freeship. iii. Every student admitted shall deposit a laboratory caution money of Rs 5,000.00 for the duration of the course, which shall be refunded deducting claims of damages if any after the completion of the course. iv. Other fees, viz. Library fee, Library Caution money, Hostel fees etc. shall be as per the University rules for the purpose.
Course 8	The course shall be of 40 credits, 20 credits for each semester. The prescribed syllabus provides for details of course structure, credit distribution and evaluation system.
Funds 9	i. The Tution Fees received and the Laboratory caution money for the course shall be maintained in a separate (joint) account operated by the Finance Officer, NEHU and the

	Course Coordinator/Head of the Department to defray expenses exclusively on running the course. ii. The University shall deduct 20% of the Tution Fees received from the course towards providing infrastructural facilities for the course. iii. Any funding of the course received either from the UGC or any other funding agency shall be deposited in the same account. iv. Other fees and deposits by the students shall be deposited into the University (Principal) accounts.
Expenditures 10	i. Instructors shall be paid honorarium as per policy laid down by the Advisory Committee from time to time. ii. All consumable expenditures shall be chargeable to the designated account. iii. TA/DA etc for external experts/guest teachers shall be charged to the designated account. iv. All repair maintenance of equipments and expenses related to softwares shall be provided by the University.
Examination 11	i. Examinations shall be conducted as per prevalent system in the University, semester-wise. ii. The University shall charge exam fee as per actual. iii. Course in–charge of each paper shall be the paper setter/examiner. However, in special circumstances external examiners may be assigned the task by the Head of the Department/Course Coordinator. iv. All semester projects shall be evaluated with assistance of an external examiner. The concerned course instructor shall be the internal examiner. v. The semester results shall be announced as per the University Calendar. However, there shall be provision for Supplementary Examination with 30 days of declaration of semester results wherein students may register to clear the back papers/improve upon papers as per University rules. But such opportunity shall be limited to only once.
Removal of Difficulty 12	In matters of disputes on interpretation or matters arising out of operation of the Course, the Vice-Chancellor of the University shall have powers to decide, which shall be final.