

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-I
Session: 2016-2017

Contact hours: 56
Credits 4

Paper-1

Remote Sensing & Image Interpretation

Unit-I

Basics of remote sensing: Electromagnetic Radiation (EMR), Electromagnetic spectrum (EMS). Platforms and sensors. Stages in remote sensing data acquisition. Types of satellites & images. Framing and scanning systems. EMR interaction with atmosphere and earth's surface. Black body radiation and radiation laws.

Unit-II

Sensors and their characteristics on board IRS, LANDSAT, SPOT, NOAA, IKONOS, Quickbird satellites. ASTER and SRTM missions. Spectral reflectance of soil, water vegetation and rock types. Spectral, spatial, temporal and radiometric resolutions.

Unit-III

Elements of image interpretation: photographic and geotechnical. Image characteristics of common land cover types. Image characteristics of common rock types- sandstone, shale, limestone, granite, basalt. Characteristics of cultural and natural features. GCPs and their utility.

Unit-IV

Mapping from remotely sensed data: Image characteristics of Flood inundation, cyclone affected areas, environmentally degraded areas, degraded land and desertified areas. Examples and case studies from India.

Suggested Books:

1. Remote Sensing-Principles and Interpretation by Sabins.
2. Remote Sensing and image interpretation by Lillesand and Keifer
3. Fundamentals of Remote Sensing by George Joseph
4. Remote Sensing of Environment by A.R. Jensen
5. Remote Sensing and Geographical Information System by Anji Reddy
6. Principal of Remote Sensing by P.J. Curran

Web sources:

www.isro.org
www.nrsc.gov.in
www.isrsindia.org, www.springerlink.com, www.elsevier.com

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Semester-I
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Credits 2

Paper-2

Fundamentals of GIS & GPS

Unit-I

Maps: elements, scale, base and reference map. Thematic maps. Toposheets: cultural and natural features. Types of Map projections: Conical Cylindrical and Azimuthal. Datum and coordinate systems.

Unit-II

Basics of GIS: data, structure, relational, hierarchical net work input, format, analysis in GIS. Data integration and overlay analysis in GIS. Functions of GIS. Digitization, editing and topology building in GIS. Concept and applications of Digital Elevation Model (DEM). Data Base Management System DBMS).

Unit-III

Introduction to Global positioning system: GPS satellite constellations, GPS segments: space, control, user, signals & codes. GPS receivers. Operating principle and sources of errors in GPS. Modes of measurements and Post processing of data, accuracy of GPS observation. GPS applications in various fields. Concept of DGPS and WAAS.

Unit-IV

Applications of GIS in natural resources mapping, socio-economic mappings and infrastructure mapping. Utility of GPS surveys in various fields. Case studies and examples from India.

Suggested Books:

1. Fundamentals of GIS by Micheal Demers
2. Remote Sensing and Geographic Information System by Anji Reddy
3. Remote Sensing and Geographic Information System by A.M. Chandra
4. Concepts and Techniques of Geographic Information System by Lo and Yeung.
5. www.GISdevelopment.net

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Paper-3

Basic Statistics and Computer Programming

Unit I

Introduction, Descriptive Statistics: Measures of Location, Measures of Variability, Skewness and Kurtosis, Data Visualization: Histograms, Box Plots, Scatter Plots

Unit II

Probability and Probability Distributions, Probability and Its Properties, Probability Distributions, Expected Value and Moments, Joint Distributions and Independence, Covariance and Correlation

Unit III

Statistical Inference: Point Estimation of Parameters, Definition and Properties of Estimators, The Method of the Moments and Plug-In Principle, The Maximum Likelihood Estimation, Interval Estimation, Hypothesis Testing, Samples From Two Populations, Probability Plots and Testing for Population Distributions, Probability Plots, Kolmogorov–Smirnov Statistic, Chi-Squared Test,

Unit IV

R : Introduction to computer programming and software packages, vectors and assignment, vector arithmetic, arrays and matrices, lists and data frames. Import/export of data objects, Defining new functions, Elements of graphics with R, Numeric and graphic summaries of data.

Suggested Books:

1. Peter Bajorski (2012): Statistics for Imaging, Optics, and Photonics, John Wiley & Sons.
2. Gupta, S.C. And Kapoor, V.K. (2000): Fundamentals of Mathematical Statistics: A Modern Approach, Sultan Chand
3. Alfred Stein Freek Van Der Meer and Ben Gorte (2002): Spatial Statistics for Remote Sensing, Kluwer Academic Publisher
4. W. N. Venables, D. M. Smith and the R Core Team: An Introduction to R Notes on R: A Programming Environment for Data Analysis and Graphics
5. M.J. Crawley (2013): The R Book, John Wiley & Sons.

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Paper-4

Aerial Photography and Photogrammetry

Unit-I

Aerial photographs: Classification of aerial photographs. Scale of aerial photographs on uniform and variable terrain. Geometry of aerial photographs. Types of aerial mosaics and their advantages. Types of aerial cameras

Unit-II

Errors in aerial photographs and their rectification: Swing, tilt, pitch, yaw. Pocket and mirror stereoscopes. Parallax bar, parallax formula, height and slope determination. Relief displacement of vertical features and its determination. Vertical exaggeration and slopes – Factor affecting vertical exaggeration and its determination

Unit-III

Detections and identification of defined objects. Interpretation of physical and cultural features: hills/ridges, valleys, plains, plateau, settlement, infrastructures, water ways etc. Interpretation, delineation and mapping of general land use. Wasteland identification and classification.

Unit-IV

Model deformation and rectification. Simple plotting Instruments – simple and stereoplotters Aerial triangulation, control and mapping Orthophotographs. Aerial photographs and their utility in mapping, measurements and terrain evaluation. Examples and case studies in India. Concept of digital photogrammetry.

Suggested Books:

- Remote Sensing of the Environment by J.R. Jenson
- Photogeology by V.C. Miller
- Photogrammetry by F.H. Moffitt and EM Mikhail
- Principles and applications of photogeology by S.N. Panday
- Gupta, R.P., 1990: Remote Sensing Geology. Springer Verlag.
- Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation , John Wiley.,
- Paine, D.P.,1981: Aerial Photography and Image Interpretation for Resource Management. John Wiley.
- Rampal K.K. 1999: Hand book of aerial photography and interpretation. Concept publication

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Paper-5

DATA STRUCTURE & DATA BASES

UNIT I: LINEAR DATA STRUCTURE

Introduction to data structures, linear and non-linear data structures, concepts of data types, single dimensional arrays, multi-dimensional arrays, operations on arrays, introduction to linked list, applications of linked list, doubly linked list, representation of stack and queues, use of stack and queues.

UNIT II NONLINEAR DATA STRUCTURE

Hierarchical form of data structure, introduction to trees, binary tree, binary search trees, traversal of binary trees: inorder, prorder, postorder, searching and inserting elements in binary trees, introduction to graph, representation of graph, traversing the graph, concept breadth first search, concept of depth first search.

UNIT III INTRODUCTION TO DATABASE

Database and its purpose, characteristics of database approach, database systems and their needs, components of database system, database System architecture, database administrator and his role, database management system and its components, types of database management systems, RDBMS, OODBMS, ORDBMS etc.

UNIT IV DATABASE MODEL

Data model: classification, Physical Model- Storage structure, Indexing Techniques; Conceptual Modeling- E/R Model, Relational Model – Definitions, Relational algebra and calculus, Integrity; SQL, Database Programming.

SUGGESTED BOOKS:

Data Structures by Lipschutz (Schaum's outline series)
Date, C. J. : "Intro. To Data Base Systems", Addison Wesley 6th ed.
Elmasri & Navathe "Fundamentals of Database Systems" 5th Edition

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Semester I

Session 2016-17

RLM-1 (Lab-1) (Papers 1 and 4) (2 credits)

Study of aerial photographs. Determination of path-row of satellite data. Border information on aerial photographs. Determination of height using single vertical aerial photographs. Determination of photo scale. Identification of various cultural and natural features on aerial photographs. Use of pocket & mirror stereoscopes. Depth perception and height and slope measurements. Identification of landforms on aerial photographs & satellite images. Drainage delineation and basin analysis. Land use/land cover mapping using satellite data.

RLM-2 (Lab-2) (Papers 2, 3 and 5) (2 credits)

Toposheet identification and reading. Exposure to GIS software: Data digitization, editing, topology building. Georeferencing and GCPs. Projection and Coordinate system in GIS. Spatial and non-spatial data and their linkage in GIS. Spatial analysis: Overlay, buffer, proximity & network analysis. GPS measurements and mapping. Use of GPS in field work/survey. Exercises related to Data structure and data bases

Ability Enhancement (AE-1) (2 credits)

Field work/Ground truth/GPS survey

Elective (Discipline Centric) E-1 (4 Credits)

- (a) Global climate Change
- (b) Basic programming concepts

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Elective Paper (E1)
(Discipline Centric)

Global Climate Change

Unit I

Components of Earth Systems – Atmosphere, hydrosphere, lithosphere and biosphere. Parameters of climate regime. Arid, semi-arid, polar, humid and sub-humid climatic regimes. Thornthwaite system of climate classification.

Unit II

Composition and structure of the atmosphere, Importance of atmosphere to human life, Change in atmospheric composition in the recent time. Burning of fossil fuel, deforestation, global land use/land cover changes. Green house gases and their effects.

Unit III

Earth's climate and its components. Change of climatic regimes in the earth's history. Global climatic changes- causes, effects and adaptation measures. Impact of climate change on water resources, agriculture, forests and land use/land cover. Case studies and examples.

Unit IV

Sea level rise- causes, impacts and adaptation measures. UNCCC-role, summits, declarations, and protocols on climate change and its mitigation. Role of IPCC in policy making.

Suggested books:

1. Kent Condie-Earth as an Evolving Planetary System-Academic Press (2004).
2. Lee R. Kump, James F. Kasting, Robert G. Crane-The Earth System-Pearson (2009).
3. Trewartha, G.T. , & Horn, L.A. , Introduction to climate, International Studies, 1990.
4. Hussain, Majid., Fundamentals of Physical Geography, Rawat Pub., Jaipur, 2001.

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Elective Paper (E1)
(Discipline Centric)

BASIC PROGRAMMING CONCEPTS

UNIT I INTRODUCTION

Introduction to programming, Introduction to 'C', Importance of 'C' language, program structure, data types, variables, expressions, statements, operators, input-output functions, some basic programs.

UNIT II JUMPING, BRANCHING, LOOPING

Decision making statements: IF, IF-ELSE, NESTED IF-ELSE, SWITCH-CASE, Repetitive statements: FOR, WHILE, DO-WHILE, Structured programming, break and continue statements, array handling, handling of character strings, some programs practice.

UNIT III BASIC DATA STRUCTURE

Introduction to linear and non-linear data structures, Arrays and its memory representation, two-dimensional arrays, program on matrices, character of array, introduction to linked list, stack and queues, introduction to trees and graphs.

UNIT III OPERATIONS OF DATA STRUCTURE

Operations of data structure: traversing, searching, inserting, deleting, linear search, binary search method, arranging the elements in order, sorting: insertion, selection, bubble, merging of two arrays, and creation of linked list.

SUGGESTED BOOKS:

Programming in C by Gotfried B. S. (Schaum's outline series)

Introduction to C by Yeshwant Kanitakr

Data Structures by Lipschutz S. (Schaum's outline series)