Ph.D Course Work Syllabus
on
Remote Sensing & GIS

Semester	Course No	Course Name	Lecture (Hours)	Credit
Ph.D Course Work (50 x 4 = 200)	RSG-111	Research Methodology	10	4
	RSG-112	Advance Statistics and Geo-spatial Techniques	10	4
	RSG-113	Advanced application of remote sensing	10	4
	RSG-114	Advanced geographic information system	10	4

Downloaded from Vidyasagar University by 14.139.211.194 on 19 Jul 2025 10:39:16 AM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=122

Ph.D Course work

Credit= 4x 4 = 16 **FM: 50 X 4 = 200**

Course -1: RSG-111: Research Methodology:

i. Research Problem: Identification and Techniques of defining a research problem, significance of literature review
ii. Statistical Inference for Research: Concepts and Procedure concerning testing of Hypothesis, Model Calibration and Validation
iii. Sampling Design: Steps in Sampling Design, Types of Sampling and their applications in research, Collection of Spatial and Temporal data.
iv. Project Management : Definition and elements of Project management, Techniques of Project Management, Roles and attributes for project manager
v. Assignment Writing

Course-2: RSG-112: Advance Statistics for Geo-spatial Analysis:

i. Concept of variables, vectors, probability and sampling / sampling design and applications
ii. Bivariate correlation and linear regression: problem of estimation and problem of inferences. Principal component analysis.
iii. Multiple linear regression: problem of estimation and inferences. Multicollinearity and heteroscadascity, problem of autocorrelation, Model Selection procedure: information criterion, variable inflation factor.
iv. Bivariate nonlinear regression: problem of estimation and inferences, Logistic regression. Concept of autocorrelation and variogram, techniques and methods of interpolation, role of interpolation for surface modeling. Geospatial Techniques: applications of RS & GIS in Geoscience research.
v. Assignment Writing

Course-3: RSG-113: Advanced application of remote sensing:

i. Thermal Remote Sensing: Basic Principles, Physical Laws, Blackbodies and Emissivity, Thermal Infrared Radiation Properties, Thermal Infrared Atmospheric Windows, Interaction of Thermal Radiation with Terrain Elements

ii. Thermal Data Processing: Thermal Energy Detectors, Thermal Radiometers, Thermal Scanners, Interpreting Thermal Scanner imaginary, Geometric Characteristics of Thermal Scanner Imaginary, Geometric and Radiometric Calibration of Thermal data, Applications
iii. Microwave Remote Sensing: Basic Principles, Microwave Remote Sensing and its advantages, Active and Passive Microwave Systems
iv. Attenuation of Microwave, Surface Scattering, Volume Scattering, Types of Antenna, Platforms and sensors, RADAR Environmental Considerations: Surface Roughness Characteristics, Electrical Characteristics, Vegetation and Water response to Microwave energy

Downloaded from Vidyasagar University by 14.139.211.194 on 19 Jul 2025 10:39:16 AM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=122

v. Radar Operation, Polarization, Spatial Resolution, Radar Image Geometry, Relief Displacement, Shadows and Speckle effect, Side Looking Airborne Radar (SLAR) Operation, Synthetic Aperture Radar (SAR), Differential Interferometry, Applications
vi. Hyperspectral Remote Sensing: Basic Concept, Advantages and Disadvantages, Multispectral vs. Hyperspectral Remote Sensing, Basic principles of Spectroscopy, Hyperspectral sensors and platforms, Sensor specifications
vii. Hyperspectral Data Processing: Atmospheric Corrections-Empirical and Physics based Approaches, Bad band and Bad line removal
viii. Information extraction:Endmember collection, Minimum Noise Fraction, Pixel Purity Index, N-D visualizer, ground truthing through Spectro-radiometer, Image Classification techniques
ix. Application of Hyperspectral Data: Application in Agriculture, Water, Soil and Mining
x. LIDAR: Basic Principles and advantages, Laser and Scanning System, Laser Location, LIDAR Antenna Attitude, Types of LIDAR returns, LIDAR post processing of multiple returns, Accuracy of LIDAR measurements, The Laser Vegetation Imaging Sensor
xi. Applications of LIDAR Data: Areas of Applications with special reference to Vegetation and Urban Infrastructure
xii. Assignment Writing

Course-4 RSG -114: Advanced geographic information system:

i. Data Storage: Spaghetti Model, Topological Model, Quadtree
ii. Database Modelling: Hierarchical Model, Network Model, Relational Model
iii. Spatial Database Management: Concept of Spatial Database, Database Management System, Basic Concepts of Entity, Relationship and Primary Key, Database Structure
iv. Data Organization: Chain Coding, Run-length Coding, Block Coding
v. Spatial Analysis: Types of Spatial Analysis, Measurement in GIS, Query – Query by Attributes, Spatial Queries, Attribute Based Operation, Neighbourhood Analysis, Connectivity Analysis, Overlay and Coverage Rebuilding,
vi. Data Quality in GIS: Uncertainty in GIS data, Positional and Attribute Accuracy, Logical consistency, Completeness Lineage,
vii. Errors in GIS:Sources of Errors in GIS data base: Obvious sources from natural variations & original measurements, Errors through processing, errors associated with overlaying of polygons, Data Quality parameters
viii. The Planet Earth, Geoids, Concept of Spherical Geometry and Geodesy, Reference Spheroid and Mean Sea Level, Introduction to different spheroid / ellipsoid systems with special reference to Everest and WGS-84 - Geometric Constants
ix. Rectangular and Geographical Coordinate System; Spherical trigonometry – concept of great circle and spherical triangle, Conversion of latitudes and longitudes to linear distances, Co-ordinate Transformations, Geoidal parameters and their relationship
x. Dimensions of some well-known Spheroids, Definition and Determination of Geoid Undulation, Coordinate System used in Geodesy, Indian Geodetic Datum; Coordinate System used by Survey of India (ϕ, λ, H), Redefinition of Horizontal and Vertical Datum in India, Indian Mean Sea Level Datum
xi. Satellite Geodesy: Early satellites, Interferometry, Doppler, Point Positioning, Translocation,
Observational systems, New Satellite gravity mission
xii Modern Views on determination of figure of the Earth: Gravimetric Methods, Astrogeodetic methods.
xiii. Assignment Writing

Downloaded from Vidyasagar University by 14.139.211.194 on 19 Jul 2025 10:39:16 AM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=122