Banaras Hindu University  
Institute of Science, Department of Geography  
One-Year P.G. Diploma in Remote Sensing and GIS  
Course Outline, 2019-20

Semester-I

<table>
<thead>
<tr>
<th>Paper Code</th>
<th>Type</th>
<th>Title</th>
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<tr>
<td>GID101</td>
<td>Theory</td>
<td>Fundamentals of Geography and Cartography</td>
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<td>GID102</td>
<td>Theory</td>
<td>Principles of Remote Sensing</td>
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<td>Theory</td>
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<td>Practical</td>
<td>Remote Sensing-I</td>
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<td>GIS-I</td>
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Semester-II

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<td>Theory</td>
<td>Advances in Remote Sensing and GIS</td>
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<td>GID 202</td>
<td>Theory</td>
<td>Digital Image Processing</td>
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<td>GID 203</td>
<td>Theory</td>
<td>Remote Sensing and GIS Applications</td>
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<td>GID 206</td>
<td>Project Work</td>
<td>Project Work/Dissertation*</td>
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Banaras Hindu University
Institute of Science, Department of Geography
One-Year P.G. Diploma in Remote Sensing and GIS
Course Outline, 2019-20
SEMESTER – I
GID101: Theory
Fundamentals of Geography and Cartography

Credits: 4
Number of Lectures: 52

Unit I
Lithosphere: Earth’s interior and crust; Rocks; Vulcanism; Earthquakes; Faults, Folds and topography; Mountain building; Types of mountains.

Unit II
Geomorphic Processes and Landforms: Geomorphic processes: Weathering, mass movements, Erosion and deposition; Landforms in humid, arid, karst, glacial and coastal environments.

Unit III
Cultural Landscape: Human settlement: types, patterns and origin; Resources: concept, classification and appraisal; Population, resources and development interrelations; Natural hazards and disasters.

Unit IV
Cartography: Earth’s size and shape: spheroidal and geoidal Earth; Spheroidal and geoidal datums; Co-ordinate systems: cartesian, rectangular and geographical; Grid systems; Map projections: Polyconic, Alber's conical equal area, LCC, Mercator and UTM

Books Recommended
Banaras Hindu University
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Course Outline, 2019-20
SEMESTER – I
GID102: Theory
Principles of Remote Sensing

Credits: 4
Number of Lectures: 52

Unit I
Basics: Electromagnetic radiation as remote sensing medium: Interactions with atmosphere and matter, remote sensing regions and bands; General mechanism of remote sensing data recording; General characteristics of remote sensing platforms; General characteristics of remote sensing sensors.

Unit II
Data Characteristics: Spectral characteristics of common natural and man-made objects; Atmospheric effects on remote sensing data; Spectral signatures and spectral response patterns; Resolutions of remote sensing data; Characteristics of raw remote sensing data

Unit III
Aerial Photos: Aerial Photos: types, scale, resolution; Geometric properties of single aerial, vertical aerial photo; Stereoscopic; Stereoscopic parallax; Relief displacement.

Unit IV
Basics of Data Interpretation: Nature of qualitative information and sequence in interpretation; Elements of image interpretation; Elements of image patterns: landforms, drainage, erosion details.

Books Recommended
Unit I
Basics: Development of GIS; Components of GIS; Basic terminologies connected with GIS; Geographical data characteristics and GIS; Coordinate systems, Datums and projections in GIS.

Unit II
Data Structures and Data Base Design: Digital representation of geographic data; Data models in GIS; Geographic data representation and conversion; Digitization: methods and errors; Topology building.

Unit III
GIS Data Standards and Modeling: GIS data standards: concepts and components; data and information sources for GIS; GIS data base management systems: conceptual and logical data modelling; Spatial data quality and error analysis; GIS customization.

Unit IV
Application Methodologies: Data compression techniques; Data interpolation; Spatial analysis through GIS; DEM/DTM models; Remote sensing data and GIS integration; GIS in project design and planning; GIS information products.

Books Recommended
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**SEMESTER – I**  
GiD104: Practical  
Remote Sensing-I  

Credits: 3

Preparation of thematic maps from remote sensing data: lithology, structure, geomorphic mapping; Land use, soils, groundwater potential zones through on-screen digitization.

**SEMESTER – I**  
GiD105: Practical  
GIS-I  

Credits: 3  
Number of Lectures: 52

Geo-referencing; Creation of PGDB; Creation of shape files, layers; On-Screen digitization of polygons, points and lines and adding attributes; Conversions and topology; Spatial analysis (in Arc-GIS and Q-GIS)
Unit I
**Thermal and Microwave Remote Sensing:** Factors affecting thermal imagery; Principles, characteristics and applications of thermal data; Principles, characteristics and applications of microwave data

Unit II
**Recent Advances in Remote Sensing:** Hyperspectral remote sensing; LIDAR; image fusions; Object oriented classification; Digital photogrammetry.

Unit III
**Spatial Analysis and Modeling:** Network analysis and shortest route characteristics; Spatial decision support system; Multi-criteria decision analysis; Spatial data infrastructures (NSDIs).

Unit IV
**Recent Advances in GIS:** 3D virtual GIS; Internet and Web-GIS; GPS in GIS applications; Mobile computing; Interoperability and open source GIS; Cartographic animation.

**Books Recommended**
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SEMESTER – II  
GID202: Theory  
Digital Image Processing

Credits: 4  
Number of Lectures: 52

Unit I  
**Basic Operations:** Digital image, digital data format, LUT; Image restoration; Noise reduction; Data registration, rectification and resampling; Histogram significance.

Unit II  
**Image Enhancements:** Correction of data: Radiometric and geometric. Radiometric enhancement; Spatial enhancements; Multi-band enhancement techniques: band ratios, vegetation indices, PCA, spatial filtering; Resolution merging techniques.

Unit III  
**Classification Methods:** Pattern recognition; Supervised, unsupervised, object oriented and hybrid classification methods; Contrast stretching: linear, non-linear methods and histogram equalization.

Unit IV  
**Information Extraction Procedures:** Multi-spectral patterns; Signature bank; Parametric and non-parametric classifiers; Multi-date data analysis and change detection processes, accuracy assessment.

**Books Recommended**
Semester – II

GID203: Theory
Remote Sensing and GIS Applications

Credits: 4
Number of Lectures: 52

A. Remote Sensing Applications

Unit I
Natural Resource mapping; Environmental mapping and monitoring; Geomorphic/geological mapping: lithology and structure; Mineral resource identification and assessment; Land use mapping;

Unit II
Evaluation of surface water resources; Ground water exploration; Flood zones; Surface runoff estimation; Glacier mapping: inventory and retreat; Soils and soil salinity mapping.

B. GIS Applications

Unit III
Rural and urban land use and information system; Crop types and crop yield estimations: disease and stress detection; rural and urban planning; Forest fire mapping.

Unit IV
GIS in health services and disease mapping; Solid waste management; Wild life habitat suitability studies; Shortest path characteristics; Spatial decision support system.

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SEMESTER – II
GID204: Practical
Remote Sensing-II

Credits: 3

Data import; Geometric corrections and geo-referencing of data; Enhancements; Subsetting; Vegetation indices; Use of filters and PCA; Supervised and unsupervised classifications; Map composition; Microwave data processing and interpretation; DEM/DTM creation and 3D visualization and virtual Image (in ERDAS Imagine and ENVI software).

SEMESTER – II
GID205: Practical
GIS-II

Credits: 3

Coverages in Arc-Info; Editing of coverages; Source data registration; Spatial modeling and analysis; Data interpolation; Data integration; Query building; Network analysis; TIN/DEM models and derivatives; 3D virtual GIS; DGPS and total station survey and plotting in GIS.

SEMESTER – II
GID206: Practical
Project Work/Dissertation*

Credits: 4

To be finalized and assigned at the end of first semester; laboratory and/or field work based; to be done in the department/elsewhere; to be submitted 35 to 45 days after the last theory/practical examination whichever is later but definitely 15 days before the reopening of the university after summer vacation

*Specialization in:
(i) GIS data organization and analysis
(ii) GIS Web Services
(iii) Natural Resource and Environment Mapping and Monitoring
(iv) Spatial Decision Support System
(v) Digital Image Analysis and Accuracy Assessment
(vi) Automated Information Extraction Methods
(vii) Rural and Urban Land Use Planning