

***Department of Planning & Geomatics  
(DoPG)  
2024-2025***

***Syllabi for Ph. D. Entrance Test  
(Geomatics)***



**Islamic University of Science & Technology  
Awantipora-192122, Kashmir**

**Part A: Research Methodology (35 marks)**

**Part B: Core Paper (35 marks)**

**Part-A: Research Methodology**

**Section-I:**

Research Fundamentals, Aims and Objectives of Research, Types of Research: Basic, Novel and Applied Research. Tools for Searching a Research Topic: Books, Journals, Internet, Discussions, Research Hypothesis; Steps in Research Design. Publication of Research, Plagiarism, Intellectual Property Rights. Quality of Research Work and Papers Indexing, Impact Factor, Citation Index, H Index. Web Resources

**Section-II:**

Basic Knowledge of Computers and Software. General Awareness of Computer Hardware, CPU and other Peripheral Devices (Input / Output and Auxiliary Storage Devices), Primary and Secondary Memory. Basic Knowledge of Software and Programming Languages. Introduction to Artificial Intelligence.

**Section-III**

Geospatial Data models and Conversions; Spatial Database concepts and Database Management System. Advanced spatial Analysis tool and techniques; Web and Mobile GIS; Open Source GIS Softwares; Basic programming and problem solving in C and Python: logical, relational, conditional operators, Control statements and Loops, Google Earth Engine.

**Sections-IV**

Measures of central tendency: mean, median, mode, Measures of Dispersion: range, Variance, standard deviation, Coefficient of variation, Skewness and Kurtosis. Regression and Correlation Analysis; Basic concepts of time series data analysis; Variogram analysis and its applications; Interpolation.

## **Part B: Core Paper**

### **Unit I: Geoinformatics Fundamentals**

**Computers and Geoinformation Management:** Flowcharts, algorithms, and programming basics (C, control statements, loops, arrays, functions). Metadata, data compression, conversion, mining, and warehousing. **Cartography & Visualization:** Concept of Digital Cartography; Types and uses of maps, Concept of scale; Coordinate systems, Geoid and datums, Map projections, Data sources for mapping, Visualization techniques, Time-series analysis, Accuracy Assessment: Sampling techniques, Error Matrix, Kappa Statistics

### **Unit II: Remote Sensing Fundamentals and Applications**

**Fundamentals:** Satellite orbits; Electromagnetic Radiation (EMR) and spectrum, Land & atmospheric Interaction of EMR, spectral signatures, aerial photography, image interpretation, Image enhancement techniques; digital data formats (BSQ, BIL, BIP); Imaging sensor and sensor characteristics, Geometric and radiometric; Distortions and corrections. **Photogrammetry:** Fundamentals of aerial photography; Vertical and oblique aerial photography; Scale, Geometry and Ground coverage of aerial photographs; Stereoscopic vision and image parallax

### **Unit III: Advanced Remote Sensing**

**Microwave Remote Sensing:** Basic Principles; Space-borne and Air-borne Radar Systems; Synthetic Aperture Radar (SAR); Sensor and Target Characteristics; SAR Interferometry; Geometric distortions. **Advanced Image Processing:** Hyperspectral Remote Sensing- Basic principles of Spectroscopy; Hyperspectral sensors and platforms; Sensor specifications; Hyperspectral Data Processing; LIDAR: Principles, data processing and platforms, Laser and Scanning System; Accuracy of Lidar measurements, thermal remote sensing, classification techniques (supervised/unsupervised), image indices, and integration of multi-sensor data.

### **Unit IV: Geographic Information System (GIS)**

GIS Basics: Components, data models (raster and vector), spatial/non-spatial data integration, topology, and analysis techniques; Neighborhood Analysis, Network analysis, Overlay analysis; Buffering; Errors and uncertainty in GIS data: Positional and attribute Accuracy; Data formats. Sampling and Interpolation techniques, Multi-criteria analysis, interpolation, DEM development, land degradation modelling; Spatial Data Infrastructures (SDI), and collaborative platforms; Open-source GIS (QGIS, GRASS) and cloud-based platforms (AWS, Azure, Google Cloud); Geospatial Web Services, Mobile GIS and real-time geospatial applications.

### **Unit V: Field Techniques, GPS, and Geodesy**

Geographic data collection, GPS components, satellite constellations, geo-positioning basics, error corrections, and GPS applications in resource mapping and crustal deformation. Field Survey Techniques: Use of spectrometers, database structures, and validation methods for geospatial data.

## Unit VI: Geospatial Data Management and Modelling

**Database Management:** Concepts, design, SQL querying, and GIS database applications; Global and Regional Geospatial databases. **Geospatial Modelling:** Estimation, spatial statistics, variogram analysis, time-series applications, and climate change impact modelling (hydrology, land cover, and agriculture).



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