SYLLABUS FOR THE POST OF LAB ASSISTANT IN THE DEPARTMENT OF GEOINFORMATICS [PGD-GEO-10]

UNIT I: REMOTE SENSING

Components of typical remote sensing systems. Radiation laws. Major satellite systems (IRS, Landsat, Sentinel). Interactions of EMR with the Earth's surface features. Elements of visual image interpretation. Image enhancement techniques. Radiometric and geometric corrections. Classification algorithms.

UNIT II: GEOGRAPHIC INFORMATION SYSTEMS

Typical components of GIS. GIS data models. Raster and vector data analysis in GIS. Open Geospatial Consortium standards. Sampling design and spatial interpolation. Multi-Criteria Decision Making in GIS. Recent trends in GIS. Issues and challenges in geospatial data conversion. Data compression techniques.

UNIT III: GNSS AND SURVEYING

Principles and techniques of surveying. Field-based instruments: Abney level, GNSS, Laser Distance meter, Total station, Terrestrial laser scanner, UAV and LiDAR, Spectroradiometer. Major global and regional GNSS. GPS accuracy, GPS signal interferences, and error corrections.

UNIT IV: GEOSPATIAL STATISTICS

Univariate and multivariate statistical analysis for geospatial data. Geostatistical approaches for spatial interpolation and extrapolation. Semivariogram and variogram for geospatial data. Data transformation and normalization techniques. Probability distribution and data redundancy techniques for spatial data.

UNIT V: GEOSPATIAL MODELLING

Distributed and lumped models, empirical models, semi-empirical models, deduction and induction models. Agent-based modelling, Nexus modelling. System dynamics approach. Model validation, calibration, and sensitivity analysis. Downscaling and upscaling of geospatial data.

UNIT VI: OPEN-SOURCE GIS

Philosophy, licensing, advantages, and global adoption of open-source GIS. Overview of major Open-Source GIS platforms (QGIS, MapWindow GIS). QGIS Plugins. Open Street Map integration in QGIS. Overview of cloud computing. Google Earth Engine Platform architecture. Computational capabilities.

UNIT VII: FUNDAMENTALS OF PROGRAMMING

Machine-level and high-level languages. C programming: character set, keywords, data types. Arithmetic, logical, relational, assignment, and conditional operators in C. Control statements and loops in C. Arrays, structures, functions, and pointers in C. Overview of JavaScript, Python, and R.

UNIT VIII: DIGITAL CARTOGRAPHY

Maps and map composition. Geoid and datum. Coordinate systems: Cartesian, cylindrical, and spherical. Map projections. Survey of India topographic maps. National geospatial data policy. Map generalization and exaggeration. NNRMS standards for mapping.

UNIT IX: GEOSPATIAL DATABASES

Global topographic datasets. Gridded population of the world. Global glacier inventories: RGI, ICIMOD, and GAMDAM. Harmonized world soil database. National Wetland Atlas and Wetland Atlas of Jammu and Kashmir. Data portals for geospatial data download: Earth Explorer, Bhuvan, Vedas.

UNIT X: GEOSPATIAL ARTIFICIAL INTELLIGENCE

Machine learning vs Deep learning. Supervised and unsupervised learning. Platforms: Jupyter notebook, Google Colab. Important libraries for geospatial data analysis. Training and testing datasets. Model overfit and evaluation matrices. Machine learning models.