Digital Terrain Model (DTM) Analysis with ArcGIS Pro

This specialized course on Digital Terrain Model (DTM) analysis with ArcGIS Pro offers an in-depth exploration of the concepts, techniques, and applications of Digital Terrain Models (DTMs) and Digital Elevation Models (DEMs). By mastering these tools and methods, participants will gain the necessary expertise to effectively represent and analyze the earth’s terrain variations. The course aims to provide a comprehensive understanding of terrain parameter extraction and spatial analysis using ArcGIS Pro, including complex applications such as line-of-sight analysis, watershed modeling, and much more.

Targeted Groups

This course is suitable for:

- **Engineers**: Especially those involved in infrastructure, construction, and environmental design.
- **Architects**: Professionals focusing on terrain analysis for urban planning and development.
- **GIS Professionals**: Those seeking to delve deeper into the specific applications of DEM and DTM in various domains.

Course Objectives

Upon successful completion of the course, participants will be able to:

- **Derive Terrain Parameters**: Analyze and interpret slope, hill shade, and aspect surfaces to evaluate terrain properties.
- **Pinpoint Locations Based on Terrain Criteria**: Identify specific areas that meet predefined elevation, slope, and aspect conditions.
- **Create Contour Lines**: Produce detailed contour maps to visualize elevation changes and gradients.
- **Generate Viewshed Raster**: Assess the visibility across landscapes using viewshed analysis.

These skills will empower participants to apply DTM and DEM analysis in practical, real-world situations such as environmental modeling, civil engineering projects, and urban planning.

Targeted Competencies

By the end of this course, participants will be proficient in:

- **Understanding Digital Terrain Models (DTM)**: Gain a deep understanding of DTMs and their applications in geospatial analysis.
- **ArcGIS Pro Interface**: Master the tools and features of ArcGIS Pro necessary for DTM and DEM analysis.
- **Data Management and Importing**: Efficiently import and manage DTM data within ArcGIS Pro.
- **Terrain Feature Analysis**: Analyze features such as elevation, slope, and aspect for in-depth terrain analysis.
- **Contour Line Creation**: Create and interpret contour lines to represent terrain elevations accurately.
- **Slope and Aspect Analysis**: Use ArcGIS Pro to analyze slope and aspect, providing insights into the terrain's characteristics.
- **Hillshading and Shaded Relief Maps**: Generate and interpret hillshade and shaded relief maps to enhance terrain visualization.
- **Hydrological Analysis**: Conduct hydrological analyses, including watershed and drainage analysis, using DTM data.
- **Geoprocessing Tools**: Use ArcGIS Pro's geoprocessing tools to perform advanced terrain analysis.
- **DTM Integration**: Integrate DTM data with other spatial datasets for comprehensive analysis.
- **Visualization and Presentation**: Effectively present terrain data and results, using various visualization techniques.

Understanding Digital Terrain Model (DTM) and ArcGIS Pro

A **Digital Terrain Model (DTM)** represents the earth's surface and topography, specifically the ground's surface, excluding vegetation, buildings, and other structures. DTMs are essential tools in geospatial analysis, offering highly detailed 3D models of terrain features that are critical for planning and analysis in environmental science, urban development, and civil engineering.

ArcGIS Pro is an advanced GIS desktop application used for a variety of geospatial tasks, including terrain analysis. It provides a comprehensive set of tools for manipulating elevation raster data, extracting terrain parameters, and creating sophisticated visualizations of the earth's surface. ArcGIS Pro's powerful geospatial capabilities make it an ideal platform for working with DTMs and DEMs, allowing users to perform spatial analysis, create maps, and integrate multiple data types.

Course Content

Unit 1: General Introduction to DTM and DEM

- **DTM vs DEM**: Understand the distinction between DTM and Digital Elevation Models (DEM).
- **Forms of DEM Representation**: Learn about different formats and

representations of DEM, including regular grids and contours.

Unit 2: Primary Representation Models of DEM

- **Regular Grid Model**: Basic structure of DEM data represented as a regular grid.
- **Contour Model**: Representation of terrain features using contour lines.
- **TIN Model (Triangulated Irregular Network)**: An advanced representation method using irregularly spaced points.
- **Hierarchical Model**: Significance and applications in DTM analysis.

Unit 3: Inter-Transformation Between DEM Models

- **Generating TIN from Irregular Points**: Learn techniques to convert irregular point sets into TIN models.
- **Grid DEM to TIN Conversion**: Understand how to convert grid DEM to TIN and the best methods to preserve important data points.
- **Contouring Techniques**: Extract contours from grid DEM and convert contours back to grid DEM for further analysis.

Unit 4: Acquisition Methods of DEM Data

- **Digital Photogrammetry**: Understand how to acquire DEM data through digital photogrammetry.
- **Quality Control of DEM Data**: Techniques for ensuring the quality and accuracy of DEM data.

Unit 5: Analysis and Applications of DEM

- **Topographic Surface Fitting**: Learn how to fit a topographic surface for accurate representations using DEM data.
- **Visibility Analysis**: Conduct comprehensive visibility and viewshed analysis to evaluate terrain visibility from specific locations.
- **Geomorphological Extraction**: Automate the segmentation and extraction of watershed features from DEM data for hydrological analysis.
- **Terrain Property Computation**: Use DEM to calculate terrain properties like slope, aspect, and curvature.

Unit 6: Analysis and Application of Triangular Network DEM

- **Interpolation within TIN**: Learn methods for interpolating terrain data within TIN models.
- **Contour Tracing**: Understand the role of contour tracing in terrain modeling and how it contributes to accurate representation of surface features.

Conclusion

By completing this course, participants will be equipped with a comprehensive understanding of Digital Terrain Models (DTM) and their application in geospatial analysis. They will become proficient in using **ArcGIS Pro** and its

specialized tools for analyzing and visualizing terrain data. The knowledge gained will empower them to make informed, data-driven decisions in a variety of fields, including urban planning, environmental management, engineering, and more.

This course is designed to provide hands-on experience and essential skills for professionals seeking to integrate terrain analysis into their work or advance their GIS capabilities for more complex geospatial challenges.