

GIS and remote sensing

Brief Preparation Instructions:

Basic GIS Concepts: Understand spatial data types (vector and raster), coordinate systems, projections, and basic spatial analysis. Be able to read and interpret maps, including map scales, legends, coordinate grids, and basic cartographic principles.

Basic Remote Sensing Principles: Familiarize yourself with the basic principles of remote sensing, including electromagnetic radiation, spatial, temporal, and spectral resolution, and the differences between passive and active (lidar, radar) remote sensing.

Data Sources and Analysis: Become familiar with widely used Earth observation products (e.g., vegetation indices, land cover maps, digital elevation models) and their typical applications in environmental monitoring. Understand common GIS operations using vector (e.g., buffering, topological overlays, attribute and spatial querying) and raster (e.g., map algebra, terrain analysis) data.

Accuracy, Limitations, and Trade-offs: Be aware of potential sources of error in spatial data. Understand the advantages, limitations, and trade-offs of different remote sensing platforms (e.g., satellites, aircraft, and drones), including the balance between spatial and temporal resolution, coverage, and cost.

Recommended Resources:

Books:

- “Geographic information science and systems” by Longley, Goodchild, Maguire, and Rhind. This book provides a comprehensive introduction to geographic information science.
- " Remote Sensing and Image Interpretation” by Lillesand, Kiefer, and Chipman. This book is one of the most widely used and respected textbooks in the field of remote sensing. It provides a thorough introduction to the fundamental principles of remote sensing.

Mathematics

Brief Preparation Instructions:

Master the Basics: Solidify your foundation in algebra, geometry, and trigonometry. Review solving equations, graphing, and basic trigonometric functions.

Understand Calculus Principles: Focus on derivatives and integrals of basic functions. Practice differentiating and integrating polynomials, exponentials, and trigonometric functions.

Grasp Probability and Statistics: Get comfortable with calculating probabilities, understanding independent and mutually exclusive events, and computing mean, median, mode, and range.

Practice with Sample Problems: Use practice questions to familiarize yourself with the test format and improve problem-solving speed.

Memorize Essential Formulas: Keep key formulas for geometry, calculus, and trigonometry ready for quick recall.

Recommended Resources:

Books:

- “Calculus For Dummies” by Mark Ryan. This book is suitable for beginners and those looking for a refresher on calculus concepts.
- “The Humongous Book of Trigonometry Problems” by Michael Kelley. This book offers a comprehensive review of trigonometry problems and solutions.

Online Resources:

- Khan Academy ([khanacademy.org](https://www.khanacademy.org)). This platform offers free courses on a wide range of topics covered in the test, including interactive exercises.
- Paul’s Online Math Notes (tutorial.math.lamar.edu). This resource provides detailed notes and practice problems on calculus topics, suitable for understanding and mastering calculus concepts.

Physics

Brief Preparation Instructions:

Review Core Concepts: Focus on mechanics, electricity, magnetism, and wave phenomena, along with environmental physics principles.

Practice Calculations: Enhance skills in solving numerical problems, especially those involving force, energy, motion, and electricity.

Understand Units: Memorize SI units for physics quantities such as force (Newton), energy (Joule), and pressure (Pascal).

Learn Formulas: Keep crucial formulas at hand for quick reference and practice applying them in various problems.

Study Diagrams: Visualize concepts such as field lines, circuit diagrams, and motion graphs to support understanding.

Recommended Resources:

Books:

- “Fundamentals of Physics” by Halliday, Resnick, and Walker. This book is a comprehensive textbook covering a wide range of physics topics.

- “Physics for Scientists and Engineers” by Serway and Jewett. This book offers detailed explanations of physics concepts along with problem-solving strategies.

Online Resources:

- Khan Academy ([khanacademy.org](https://www.khanacademy.org)). This platform provides free tutorials on many physics topics, from basic principles to more advanced concepts.
- HyperPhysics (hyperphysics.phy-astr.gsu.edu). This online resource offers concise explanations and diagrams across a broad range of physics topics.

Hydroclimate

Brief Preparation Instructions:

- **Study the Hydrologic Cycle:** Understand processes like evaporation, condensation, precipitation, infiltration, and runoff.
- **Learn about Soil and Aquifers:** Focus on soil permeability, groundwater flow, and aquifer types.
- **Understand River Systems:** Know about river discharge, drainage basins, and features of river channels.
- **Grasp Atmospheric Conditions:** Learn how atmospheric conditions like temperature and pressure affect hydroclimatology.
- **Review Water Quality Indicators:** Familiarize yourself with indicators like pH level, turbidity, and biological oxygen demand (BOD).
- **Study Weather Patterns and Climate Effects:** Understand the impact of climate phenomena like El Niño on hydrology.

Recommended Resources:

Books:

- "Hydrology and the Management of Watersheds" by Kenneth N. Brooks, Peter F. Ffolliott, and Joseph A. Magner. This book covers fundamental hydrology concepts, watershed management, and the hydrologic cycle comprehensively.

Online Resources:

- Coursera offers various courses related to hydrology and water management. Look for courses like "Water and Climate Change" or "Introduction to Hydrology" that can provide a structured learning path with practical examples.

- The US Geological Survey (USGS) Water Science School (water.usgs.gov/edu) offers detailed information on many aspects of water, including the water cycle, water properties, and water management issues.