

## Geodesy

### 1. What is geodesy?

Geodesy is a branch of applied mathematics and earth sciences, is the scientific discipline that deals with measurement and representation of the Earth.

### 2. Where does the word "Geodesy" come from?

Geodesy came from the Greek word "Geodaisia", literally "division of the Earth".

### 3. How do we divide geodesy?

Geodesy is divided into "Higher geodesy" which is concerned with measuring the Earth on the global scale, and "Practical geodesy" or "Engineering geodesy" which is concerned with measuring the specific parts or regions of the Earth and which includes surveying.

### 4. What geodesists study?

Geodesists study geodynamical phenomena such as polar motion, tides and crustal motion.

### 5. How was the Earth seen in the Hellenic world?

The Earth was seen as a flat disc advocated by Homer and spherical body postulated by Pythagoras, an idea supported later by Aristotle.

### 6. Who were the first who tried to determine the circumference of the Earth?

First who tried to determine the circumference of the Earth were Plato and Archimedes.

### 7. Who was Eratosthenes? Which facts and observations did he used to measure the circumference of the Earth?

Eratosthenes was Greek scholar and philosopher. He had heard that on the longest day of the summer solstice, the midday sun shone to the bottom of the well in the town of the Syene (Aswan). At the same time, he observed the sun was not directly overhead at Alexandria, instead, it cast a shadow. To these observations, he applied certain known facts: On the summer solstice, the midday sun was directly over Tropic of Cancer, Syene was on this Tropic, Syene and Alexandria lay on the direct north-south line, sun was relatively long away.

### 8. Whose maps influenced the cartographers of the Middle Ages?

The maps of Ptolemy strongly influenced the cartographers of the Middle Ages.

### 9. Who was Mercator? What did he do?

Mercator was the Flemish cartographer. He made successive reductions in the size of Mediterranean Sea and all of the Europe which had effect increasing the size of the Earth.

### 10. What advances were made in the early modern period?

The invention of the telescope and the theodolite and the development of logarithm tables allowed exact triangulation and grade measurement.

### 11. Who was Jean Picard? What did he do?

Jean Picard performed the first modern meridian arc measurement in 1669 to 1670.

### 12. What was established in the late 19<sup>th</sup> century?

In the late 19<sup>th</sup> century the Central Bureau for International Geodesy was established by Austria-Hungary and Germany.

### 13. What was its goals?

One of its most important goals was the derivation of international ellipsoid and gravity formula which should be optimal not only for Europe but also for the whole world.

### 14. What happened in the 1919?

In 1919 were founded the International Association of Geodesy and International Union of Geodesy and Geophysics.

## Surveying

### 15. What is surveying?

Surveying or land surveying is the technique, profession and science of accurately determining the position of points and the distances and angles between them, commonly practiced by surveyors. These points are often used to establish maps and boundaries for ownership, locations or other purpose required by government or civil law, such as property sales.

### 16. What do surveyors use?

Surveyors use elements of mathematics, physics, engineering and the law. Surveying equipment includes total stations, robotic total station, GPS receivers, prisms, 3D scanners, radios, handheld tablets, digital levels and surveying software.

### 17. What is "land surveying"?

Land surveying is the detailed study or inspection, as by gathering information through observations, measurements in the field, questionnaires, or research of legal instruments, and data analysis in the support of planning, designing and establishing of property boundaries.

### 18. How long have people been using surveying?

People have been using surveying about 6 000 years.

### 19. When is surveying required and what is its most familiar modern use?

Surveying is required in the planning and execution of nearly every form of construction. It's most familiar modern uses are in the fields of transport, building and construction, communications, mapping and the definition of legal boundaries for land ownership.

### 20. What is total station?

A total station or TST (total station theodolite) is an electronic/optical instrument used in modern surveying and building construction.

### 21. What is a robotic total station?

Robotic total station allow the operator to control the instrument from a distance via remote control. This eliminates the need for an assistant.

### 22. What is cadastre?

A cadastre is a register of the real estate or real property's boundaries.

### 23. What does cadastre includes?

Cadastre includes details of the ownership, the tenure, the precise location, the dimension and area, the cultivations if rural and the values of individual parcels of land.

### 24. Why do legal systems use the cadastre?

Legal system use the cadastre to define the dimensions and location of land parcels described in legal documentation.

## Geodetic measurements

### 25. What is the level used for?

The level is used for determining height differences and height reference systems, commonly referred to mean sea level.

**26. What is the mean sea level?**

Mean sea level is an average level for the surface of one or more of Earth's oceans from which heights such as elevations may be measured. MSL is a type of vertical datum that is used, for example, as a chart datum in cartography and marine navigation.

**27. What is theodolite used for?**

The theodolite is used to measure horizontal and vertical angles to target point.

**28. What does the tachometer do?**

The tachometer determines, electronically or electro-optically, the distance to target, and is highly automated to even robotic in its operations.

**29. What is used for local detail surveys?**

For local detail surveys, tachometers are commonly employed although the old-fashioned rectangular technique using angle, prism and steel tape is still an inexpensive alternative.

**30. What is GIS?**

A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.

**31. How is gravity measured?**

Gravity is measured using gravimeters.

**32. Describe the two types of gravimeters.**

The two types of gravimeters are relative and absolute gravimeters.

Absolute gravimeters are made compact so they too can be used in the field, work by directly measuring the acceleration of a mass during free fall in a vacuum, when the accelerometer is rigidly attached to the ground.

Relative gravimeters are used in gravity surveys over large areas for establishing the figure of the geoid over those areas. Most common relative gravimeters are spring-based. This gravimeters is basically a weight on a spring and by measuring the amount by which the weight stretches the spring, local gravity can be measured.

## **Plane Surveying**

**33. What is plane surveying?**

Plane surveying is the survey in which the earth surface is assumed to be plane and the curvature of the earth is ignored. This surveying involves smaller areas less than about 260 km<sup>2</sup> and it has lower degree of accuracy.

## **Geodetic Surveying**

**34. What is geodetic surveying?**

Geodetic surveying is the survey in which the curvature of the earth is taken into account and higher degree of accuracy in linear and angular observations is achieved. This surveying involves larger areas more than about 260 km<sup>2</sup> and lines connecting any two points on the surface of the earth are treated as arcs.

## **Classification of Survey**

**Surveys are classified under the three different heads.**

1. Classification based upon the nature of the field
2. Classification based on the purpose of the survey
3. Classification based on instruments used.

Classification based upon the nature of the field is divided into “Land surveys” and “Hydrographic Surveys”.

Land surveys are divided into “Topographical surveys”, “Cadastral surveys” and “City surveys”.

Topographical surveys determine the natural features of a country such as hills, valleys, rivers lakes, wooded areas and the artificial features such as roads, railways, towns, villages, canals, buildings.

Cadastral surveys determine the boundaries of fields, houses, estates and other properties.

City surveys are carried out for the construction of roads, parks, water supply system, sewer system and other constructional works.

Hydrographic Surveys deal with the measurement of water bodies like seas, rivers, lakes, gulfs.

Classification based on the purpose of the survey is divided into “Engineering or Project Surveys”, “Military or Defense Surveys”, “Mine or Exploratory Surveys”, “Geological Surveys”, “Archeological Surveys”, “Marine or Navigation Surveys” and “Reconnaissance Survey”.

Military or Defense Surveys is the surveys which are carried out for preparation of maps of the areas of strategic or military importance.

Reconnaissance Survey is preliminary survey to inspect the area before the actual detailed survey to ascertain how the survey works can be executed in the best possible ways.

**Classification of survey based on instruments used:**

1. Chain surveying
2. Compass surveying
3. Plane table surveying
4. Theodolite surveying
5. Stadia or Tacheometric surveying
6. Triangulation surveying
7. Photogrammetric surveying