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**DEPT: CIVIL ENGINEERING**

**COURSE CODE; CVE 310**

**COURSE NAME; ENGINEERING SURVEY**

**QUESTION 1:** Discuss the benefits of GPS over other forms of equipment for measuring

 **Answer**

**Benefits of GPS**

1. Relatively high positioning accuracies, from tens of meters to millimeter level.
2. It is an all-weather system, available 24 hours a day.
3. Capability of determining velocity and time to an accuracy commensurate with position
4. The position information in three dimensions, i.e. vertical as well as horizontal information is provided.
5. Signal availability to users anywhere on the globe (in air, on the ground, or at sea)
6. It is a system with no user charges and uses relatively low cost hard ware.

**QUESTION 2:** like most measuring equipment the GPS is not infallible. Discuss the type of errors associated with absolute GPS positioning mode,

**ERRORS ASSOCIATED WITH ABSOLUTE GPS POSITIONING MODE**

1. Ephemeris errors and orbit perturbations.
2. Clock stability.
3. Ionospheric delays.
4. Tropospheric delays.
5. Receiver noise.
6. Signal Multi-path.
7. Satellite and receiver clock errors.
8. Selective availability.
9. Anti-Spoofing.
10. **Ephemeris errors and orbit perturbations:** satellite ephemeris error are errors in the prediction of a satellite position which may then be transmitted to the user in the satellite data message. Ephemeris errors are satellite dependent and are very difficult to correct and compensate while modelling the orbit of a satellite because many forces acting on the predicted orbit of a satellite are difficult to measure directly.
11. **Clock stability:** GPS depends on accurate time measurement. GPS satellites carry rubidium and cesium time standards that are usually accurate to 1 part in 1012 and 1 part in 1013, respectively, while most receiver clocks are accurate by quartz standard of 1 part in 108.
12. **Ionospheric delays;** GPS signals are electromagnetic and as such are non-linearly dispersed and refracted when transmitted through highly charged environment ionosphere.
13. **Tropospheric delays.** The troposphere is that part of the atmosphere which is close to the earth. It extends from the surface of the earth to about 9km over the poles and 16km over the equator. The troposphere delays add a slight distance to the range the receiver measures between itself and the satellite.
14. **Receiver noise:** receiver noise includes a variety of errors associated with the ability of the GPS receiver to measure a finite time difference. These include signal processing, receiver resolution, clock/signal synchronization and correlation models.