

Global Positioning System - Web course

COURSE OUTLINE

This course introduces the fundamental and advanced concepts, and applications of Global Positioning System (GPS) to the undergraduate and postgraduate students of civil engineering.

Contents:

Definitions and fundamentals of Geodesy, Introduction to GPS-Transit, NAVSTAR GPS, GLONASS, GALILEO; GPS segments-space, control and user, GPS codes- C/A, P, GPS receivers, GPS Orbits, GPS errors and accuracy, GPS Observables, GPS Survey Methods- static vs kinematic, single point vs relative positioning, GPS Modernization plans, GPS Applications.

COURSE DETAIL

Sl. No.	Topic	No. of Hours
1	Introduction to Geodesy: Definitions and fundamentals of Geodesy, Earth, Geoid and Ellipsoid of rotation, Reference surface, Geodetic systems, Indian Geodetic System, Coordinate systems and transformation.	02
2	Introduction to GPS: <i>History:</i> Transit, Timation, NAVSTAR GPS, GLONASS, GALILEO. GPS design objectives and details of <i>segmentsspace</i> , control and user, blocks of GPS- Block I, II/IIA, IIR Satellites, IIF, Advantages and current limitations of GPS, Status of GPS Surveying, Applications.	04
3	GPS Signal structure: Carriers, GPS codes: C/A, P, navigational message, GPS receiver: Types and Structure of receivers, Principles of GPS position fixing: Pseudo ranging.	04
4	GPS Orbits: Determination of GPS satellite coordinates, Types of ephemerides, GPS data formats: RINEX, SP3.	02



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Civil Engineering

Pre-requisites:

1. Principles of Surveying.

Additional Reading:

1. *Journals* - GPS World, Coordinates.

Hyperlinks:

1. www.trimble.com/gps
2. www.gisdevelopment.net/tutorials/tuman004.htm

Coordinators:

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5	<p>GPS errors and accuracy:</p> <p><i>Satellite dependent:</i> Ephemeris errors and orbit perturbations, Forces on GPS satellites, Effects of orbital bias, Types of satellite ephemerides, Satellite clock bias, Selective availability.</p> <p><i>Receiver dependent:</i> Receiver clock bias, Cycle slip, Selective availability (SA).</p> <p><i>Observation medium dependent:</i> Ionospheric errors, Tropospheric errors.</p> <p><i>Station dependent:</i> Multipath, Station coordinates.</p> <p><i>Satellite geometry based measures:</i> Geometry dependent (Dilution of Precision: DOP), User Equivalent Range Error UERE.</p>	05
6	<p>GPS Observables:</p> <p>Introduction to adjustment computations, Observation equations, Code-based, Carrier phase-based.</p> <p>Navigational solution: Code/phase based, Data Processing Models, Models for single point positioning and relative/differential positioning, Data combinations, Ambiguity resolution, Single difference, Double difference, Triple difference, Static relative positioning, Kinematic relative positioning.</p>	05
7	<p>GPS Survey Methods:</p> <p>Single Point or Point Vs Relative, Static Vs Kinematic, Real time Vs Post mission.</p> <p>Practical GPS survey field procedures: Code- and Carrier-based positioning, Accuracy and recording time.</p> <p>Preparation of GPS surveys: Setting up an observation plan, Practical aspects of field observations, Observation strategies, Network design.</p>	08
8	<p>GPS Modernization plans:</p> <p>Future developments in GPS, Introduction to GLONASS and GALILEO systems.</p>	03
9	<p>GPS Applications:</p> <p>Geodetic control surveys, Cadastral surveys, Photogrammetry, Remote sensing, Engineering and monitoring.</p> <p>Military applications, Geographical Information System, Vehicle tracking and car navigation, LBS and special applications.</p>	07

References:

1. P. R. Wolf, and C. D. Ghilani, 1997. Adjustment Computations: Statistics and Least Squares in Surveying and GIS, Publisher: John Wiley & Sons, New York (USA), pages 564.
2. J. V. Sickle, 2001. GPS for Land Surveyors Publisher: Ann Arbor Press, Michigan(USA), pages 284.
3. B. Hofmann-Wellenhof, H. Lichtenegger and J. Collins, 1994. Global Positioning System: Theory and Practice, Publisher: Springer, Berlin (Germany), pages 355.
4. Gunter Seeber, 2003. Satellite Geodesy, Publisher: Walter de Gruyter, Berlin (Germany), pages 612.
5. A. Leick, 2004. GPS Satellite Survey (2nd ed.), Publisher: John Wiley & Sons, New York (USA), pages 429.
6. Xu Guochang, 2007. GPS: Theory, Algorithms and Applications, Publisher: Springer, Berlin (Germany), pages 353.
7. J.V. Sickle, 2004. Basic GIS Coordinates, Publisher: CRC Press LLC, pages 173.
8. W. Schofield, 2001. Engineering Surveying (5th ed.), Publisher: Butterworth- Heineemann, pages 521.
9. Agrawal, N. K, 2006. Essentials of GPS, Publisher: Spatial Networks, pages 45.
10. Bradford W. Parkinson, James J. Spiker Jr, 1996. Global Positioning System: Theory and Applications, Vol I and II, American Institute of Aeronautics and Astronautics: Washington.
11. Strang, Gilbert and Borre, Kai, 1997. Linear Algebra, Geodesy, and GPS, Publisher: Wellsley-Cambridge: Wellsley, pp. 622.