

## 4/4 B.Tech - EIGHTH SEMESTER

EC 8T3D

Global Positioning System (GPS)

Credits: 4

Lecture : 4 periods/week

Tutorial: 1 period /week

Internal assessment: 30 marks

Semester end examination: 70 marks -----

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### Course Objectives:

- To be able to utilize GPS/GIS applications and techniques for environmental inventory and research.
- To understand the mechanics of GPS/GIS, including software, hardware and available resources.
- To interpret and analyze data in a GIS environment.
- To gain 'real-world' experience while serving the local community through service-learning projects

### Learning Outcomes:

- Students are able to analyze GPS signals and their characteristics
- Students can understand GPS errors and sources causing those errors
- Students can simulate different algorithms of GPS using MATLAB programming and results can be analyzed to study different parameters
- Students can find new applications of GPS in medicine, transportation, manufacturing and engineering for the betterment of human life.

### UNIT-I

**Overview of GPS :** Basic concept, system architecture, space segment, user segment, GPS aided Geo-augmented navigation (GAGAN) architecture.

### UNIT-II

**GPS Signals :** Signal structure, anti-spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

### UNIT-III

**GPS coordinate frames, Time references:** Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS time.

### UNIT-IV

**GPS orbits and satellite position determination:** GPS orbital parameters, description of receiver independent exchange format (RINEX) – Observation data and navigation message data parameters, GPS position determination.

## **UNIT-V**

**GPS Errors:** GPS error sources – clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver.

## **UNIT-VI**

**Parameterization and Algorithms of GPS Data Processing I:** Evidence of the Parameterization Problem of the Undifferenced Observation Model, A Method of Uncorrelated Bias Parameterization, Geometry-Free Illustration, Correlation Analysis in the Case of Phase-Code Combinations, Equivalence Theorem of GPS Data Processing Algorithms, Optimal Baseline Network Forming and Data Condition, Algorithms Using Secondary GPS Observables.

## **UNIT-VII**

**Parameterization and Algorithms of GPS Data Processing II:** Non-Equivalent Algorithms: Standard Algorithms of GPS Data Processing, Preparation of GPS Data Processing, Single Point Positioning, Standard Un-Differential GPS Data Processing, Equivalent Method of GPS Data Processing, Relative Positioning, Velocity Determination, Kalman Filtering Using Velocity Information

## **UNIT-VIII**

**Applications of GPS Theory and Algorithms:** Software Development : Functional Library, Data Platform, A Data Processing Core, Concept of Precise Kinematic Positioning and Flight-State Monitoring: Introduction, Concept of Precise Kinematic Positioning, Concept of Flight-State Monitoring.

## **Learning Resources**

### **Text Books:**

1. GPS – Theory and Practice, B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, Springer–Wien, New York, 2001.
2. GPS Theory, Algorithms and Applications, Guochang Xu, 2<sup>nd</sup> Edition ,Springer

### **References:**

1. Fundamentals of GPS receivers – A software approach, James Ba, Yen Tsui, John Wiley & Sons, 2001.