

**Asian Institute of Technology**  
School of Engineering and Technology

**AT76.9029 Introduction to Global Navigation Satellite Systems 1(1-0)**

**Semester: August**

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**Course Objective:** The aim of this course is to introduce the principles of the Global Navigation Satellite Systems (GNSS), Satellite Positioning, GNSS Signal Structures and to demonstrate its applications to various aspects of location-based services and geospatial sciences.

**Learning Outcomes:**

The students on the completion of this course would be able to:

1. Understand fundamental theory and applications of radio navigation with the Multi-GNSS.
2. Develop understanding of satellite orbit theory, GNSS signal structure, point positioning with pseudorange, real-time kinematic positioning with carrier phase, dilution of precision and atmospheric effect on GNSS signals.
3. Perform calculation on position, Dilution of precision (DOP) using RTKLIB

**Pre-requisite:** None

**Course Outline:**

- I. Introduction
  1. Introduction of GNSS Technology
  2. GNSS Signal Structures
  3. GNSS Vulnerabilities
  4. GNSS Applications
  5. GNSS Market and Business
  
- II. Principles of satellite positioning
  1. Principle of Satellite Positioning
  2. GNSS Orbits
  3. Coordinate Systems
  4. Navigation Message Details
  5. Positioning Errors
  6. Data Formats
  
- III. GNSS Receiver
  1. GNSS Receiver Introduction
  2. Software Receiver
  3. Demo using GNSS Receiver
  
- IV. GNSS based Precise Position

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School Recommendation: \_\_\_\_\_ ADRC Approval: \_\_\_\_\_

Academic Senate Approval: \_\_\_\_\_

1. Differential GNSS (DGNSS)
2. Real Time Kinematic (RTK)
3. Precise Point Positioning (PPP)
4. Software for GNSS processing

V. GNSS Applications

1. GNSS Trends
2. Core and enabled markets
3. User Technology Trends
4. Location-Based Services (LBS)

**Learning Resources:**

Textbook: No designated textbook, but class notes and handouts will be provided.

Reference Books:

*Pratap Misra, Per Enge:*

Global Positioning System: Signals, Measurements, and Performance (Revised Second Edition), Ganga-Jamuna Press, MA, 2010.

*Bernhard Hofmann-Wellenhof, Herbert Lichtenegger, Elmar Wasle:*

GNSS - Global Navigation Satellite Systems: GPS, GLONASS, Galileo, and more, Springer, NY, 2007.

**Journals and Magazines:**

1. Journal of Global Positioning Systems, Springer
2. International Journal of Navigation and Observation, Hindawi Publishing Corporation
3. Coordinates, Coordinates Media Pvt Ltd
4. GIM International, Geomares Publishing

**Others:** None

**Teaching and Learning Methods:**

1. **Lectures and class discussion:** Students will receive the lecture notes and the lecture schedule before the course, and requested them to review the lecture notes after the class.

**Time Distribution and Study Load:**

Lecture = 15 Hrs

Other self-studies = 30 Hrs

**Evaluation Scheme:**

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Final examination (open book, on computer): 100%

In the examination, an "A" would be awarded if a student can elaborate the knowledge learned in the class by giving his/her own basic skills and knowledge of GNSS completely. A "B" would be awarded if a student shows an overall understanding of all give topics, a "C" would be given if a student meets below average expectation on both knowledge acquired and analysis. A "D" would be given if a student does not meet basis expectations in understanding and analyzing the topics and issues presented in course.

**Instructors:** Dr. Hiroyuki Miyazaki, Visiting Faculty

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School Recommendation: \_\_\_\_\_ ADRC Approval: \_\_\_\_\_

Academic Senate Approval: \_\_\_\_\_