



AMITY UNIVERSITY

UTTAR PRADESH

Course Title: Satellite Navigation System

Course Code: ECE744

Credit Units: 4

Level: PG

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	0	2	0	4

Course Objectives:

This course explores the use of satellite, terrestrial for the real-time determination of position, velocity, and time. Particular emphasis is on the historical importance of navigation systems; the Global Positioning System; and other constellation and emerging trends for integrating various navigation techniques of GNSS into single, tightly coupled systems.

Prerequisites:

The student should have a preliminary understanding of digital communication

Course Contents / Syllabus:	Weightage (%)
Module I Introduction	20%
Historical development of navigation, methods of navigation, principle of hyperbolic navigation, loran, omega, DME etc	
Module II: Time and coordinates	20%
Four Satellite ranging system- Principle, coordinates reference system., Earth centered Earth Fixed (ECEF), WGS84, Time reference system. clocks, its importance, current state of the art of clock, UTC, date and time	
Module III: GPS and its Architecture	20%
<ul style="list-style-type: none">• GPS constellation and visibility, GPS : space , control and users segments . GPS Architecture.• Signal structure : frequencies, multiple access technique, spread spectrum technique , Code C/A , P(Y).• GPS Data Message.	
Module IV: GPS receiving system and Accuracy	20%
GPS receivers, Block Diagram , and architecture. Signal Processing <ul style="list-style-type: none">• Correlation, Acquisition, tracking, impact of the perturbation on the tracking.	

GPS error sources: satellite clock error & ephemeris error, multipath, interference & jamming, tracking , loop errors, ionosphere and troposphere propagation errors, interferences, multipath. Accuracy of positioning and timing Performances : D.O.P, Accuracy, Availability, Integrity, Continuity.	
Module V: Other constellations	20%
GNSS: GLONASS, GALILEO, Compass, Modernized GPS, Augmentation systems, Integration of different constellations, applications of GNSS	
List of Laboratory Experiment (Simulation)	
<ol style="list-style-type: none"> 1. Satellite orbits 2. Study of satellite azimuth and elevation window using sky plot 3. Study of PRN code BPSK and BoC modulation 4. Analysis of NMEA Protocols 5. Study of UTC Date & Time 6. Corrected pseudoranges 7. Study of Signal Strength View, Sky Plot View & Position Plot 8. Navigation constellation 9. Receiver simulation 	

Student Learning Outcomes:

1. Demonstrate professional insight and competencies in principles of navigation,
2. Demonstrate a clear understanding of the GPS signal and issues with satellite positioning
3. Evaluate critically about emerging areas and new technology value.
4. Perform capably in Navigation industry

Provide leadership in this technology

Pedagogy for Course Delivery:

The class will be taught using theory and lab. In addition examples will be demonstrated using simulator/real hardware. Home Assignments will be based on practical examples of digital design using verilog& System Verilog.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical (%)	Total
80%	20%	100%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Mid-Term Exam	Project	Viva	Attendance	
Weightage (%)	10%	8%	7%	5%	70%

Lab Assessment (P):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	A	PR	LR	V	
Weightage (%)	5%	10%	10%	5%	70%

A: Attendance, PR- Performance, LR – Lab Record, V – Viva. EE- External Exam,

Text & References:

- Hofmann-Wellenhof, Bernhard, Lichtenegger, Herbert, Wasle “GNSS – Global Navigation Satellite Systems”, Elmar 2008. ISBN 978-3-211-73017-1
- P. Misra and P. Enge, “Global Positioning System: Signals, Measurements, and Performance,” Hall Street Press, 2001, ISBN 0970954409.
- M. Kayton and W. R. Fried, “Avionics Navigation Systems,” Wiley & Sons, 1997, ISBN 0471547956.
- E. Kaplan, “Understanding GPS Principles and Applications,” Artech House, 1996, ISBN 0890067937.