



## EE459-Satellite Communications (Elective Course)

**Code and Name:** EE 459 Satellite Communications

**Credit Hours:** 3 (Lecture: 3, Tutorial: 1)

**Textbook:**

- Satellite Communication, Dennis Roddy, Third Edition, McGraw Hill Publications, 2001.

**Other References:**

- M. Richaria, Satellite Communication Systems Design Principles, Pearson Publications, Second edition, 1999.
- Pratt, Timothy, and Charles W. Bostian, Satellite Communication, John Wiley and Sons, New York, 1986.

**Course Description:**

Origin of satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, frequency allocations for Satellite Services Applications, Future trends of Satellite Communications. Orbital mechanics and launchers: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance. Satellite subsystem. Satellite antenna equipment reliability and Space qualification. Satellite link design. Multiple access techniques. Earth station technology. Low Earth orbit and Geo-stationery Satellite systems. Very Small Aperture Terminal (VSAT) System. Satellite Navigation and Global positioning system (GPS).

**Pre-requisites:** EE451.

**Co-requisites:** None

**Course Learning Outcomes:**

With relation to ABET Student Outcomes (SOs: 1-7)

1. Describe satellite communication components, its applications, frequencies and environment. (1)
2. Identify orbital types, elements, mechanics and laws. (1)
3. Determine satellite look angles and orbital period. (1)
4. Explain satellite subsystems and antenna types used in satellite systems. (1)
5. Identify propagation effects in satellite communication for different frequency bands. (1)
6. Design up link and down link for satellite system. (2)
7. Determine system noise temperature for satellite receiver. (1)
8. Describe multiple access techniques in satellite system, and their advantageous and disadvantageous. (1)
9. Describe the VSAT and GPS systems in terms their operation method, components and applications. (1)

**Topics to be covered:**

- Introduction to satellite communication:
- Orbital mechanics and launchers: Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.
- Low Earth orbit and Geo-stationery satellite systems
- Satellite Subsystem: Attitude and orbit control system, telemetry, tracking, command and monitoring subsystems; power systems; communications subsystems; satellite ant. eqpt reliability and space qualification.
- Earth station technology: Tx/Rx, antennas, tracking systems, terrestrial interface, primary power test methods.
- Satellite link design: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, Up link design, Design of satellite links for specified C/N, System design example.
- Multiple Access: FDMA , intermodulation, calculation of C/N, TDMA, frame structure examples, satellite switched TDMA onboard processing, CDMA, spread spectrum transmission and reception.
- Satellite applications: VSAT and GPS.

**Grading Policy:**

The grading for the course are 60% coursework and 40% Final Exam. The coursework consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes quizzes, homework, and projects for the remaining 20% that is modified by the course instructor.

