

### EC439 SATELLITE COMMUNICATIONS (Dept. Elective - III)

#### Course Description & Objectives:

The course covers Fundamentals of satellite communications, its sub-systems, signals and noise associated with satellite communications and transmission concepts. The objective is to introduce the mechanics of satellite, satellite launchers and also study the design issues and operation of satellite systems.

#### Course Outcomes:

Upon successful completion of this course, students should be able to:

- Evaluate the advantages and disadvantages of the different types of satellite orbits
- Perform calculations to determine properties of earth station antennas and satellite footprints.
- Perform calculations required to conduct a link budget analysis of a satellite system.
- Conduct a thorough analysis and comparison of two competing satellite systems.
- Calculate an accurate link budget for a satellite or other wireless communications link.
- Understand how analog and digital technologies are used for satellite communications networks and the topologies and applications of those networks, as well as the comparison to alternative communications systems

#### UNIT I - Introduction & Orbital Mechanics and Launchers :

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, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

**UNIT II - Satellite Subsystems :**

Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antennas Equipment reliability and Space qualification.

**UNIT III - Satellite Link Designing :**

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.

**UNIT IV - Multiple Access :**

Frequency division multiple access (FDMA) Intermediation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple access (CDMA), Spread spectrum transmission and reception.

**UNIT V - Low Earth Orbit and Geo-Stationary Satellite Systems & Satellite Navigation and the Global Positioning System :**

Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, Operational NGSO constellation Designs Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

**TEXT BOOKS :**

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, "Satellite Communications", 2nd ed., Wiley Publications, 2003.
2. M. Richharia, "Satellite Communications: Design Principles", 2nd ed., BS Publications, 2003.

**REFERENCE BOOKS :**

1. Dennis Roddy, "Satellite Communications", 2nd ed., McGraw Hill, 1996.
2. Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, "Satellite Communications Engineering", 2nd ed., Pearson Publications, 2003.
3. V.S.Bagad, "Satellite Communications", 1<sup>st</sup> ed., 2009, Technical Publications, Pune.