

4/4 B.Tech - EIGHTH SEMESTER

EC 8T1

Satellite Communications

Credits: 4

Lecture : 4 periods/week

Tutorial: 1 period /week

Internal assessment: 30 marks

Semester end examination: 70 marks

Course Objectives:

- To understand the basic concepts of satellite communication, its applications and feature trends.
- To study the orbital mechanics, its effects in communication system performance, launch vehicles and details of various satellite subsystems.
- To study the working of various components in earth station technology, and to study Low Earth Orbit (LEO), Geostationary Earth Orbit (GEO) and Non-geostationary Earth Orbit (NGEO) satellite systems.
- To study the principles of working of radio and satellite navigation systems and global positioning systems in detail.

Learning Outcomes:

- Students are aware of different satellite launchers & orbital mechanics.
- Students are aware of the earth station technology & satellite link design for transmission & reception of signals for control, command & communication.
- Students are aware of the principles of working of radio & satellite navigation systems & global positioning systems.

UNIT-I

Introduction : Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications

UNIT-II

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

UNIT-III

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

UNIT-IV

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.

UNIT-V

Multiple Access: Frequency division multiple access (FDMA) Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple access (CDMA).

UNIT-VI

Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods

UNIT-VII

Low Earth Orbit And Geo-Stationary Satellite Systems: Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations.

UNIT-VIII

Satellite Navigation & The Global Positioning System: Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation.

Learning Resources

Text Books :

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnut, WSE, Wiley Publications, 2nd Edition, 2003
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud Pearson Publications, 2nd Edition, 2003.

References:

1. Satellite Communications : Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003
2. Satellite Communication - D.C Agarwal, Khanna Publications, Mc.Graw Hill, 5th Edition, 2008.
3. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004.
4. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996