**EX 725 02**

**Course Objectives:**

1. To enable the student to become familiar with satellites and satellite services
2. To get an overview of satellite systems in relation to other terrestrial systems
3. To study about satellite orbits, launching, link design, multiple access techniques, propagation effects and their impact on satellite-earth links
4. To study about VSAT systems, Satellite TV, radio and GPS
5. **Overview of satellite communication (2 hours)**
   1. Introduction
   2. Frequency Allocations for Satellite Services
   3. Intelsat
   4. U.S.Domsats
   5. Polar Orbiting Satellites

1. **Orbital mechanics and launchers (10 hours)**
   1. Kepler’s laws
   2. Newton’s law
   3. Orbital parameters
   4. Orbital Mechanics
   5. Look Angle Determination
   6. Orbital perturbations
   7. Orbit Control system
   8. Geo stationary orbit
   9. Telemetry, tracking, Command and monitoring
   10. Power systems
   11. Communication subsystems
   12. Transponders
   13. Satellite Antennas
   14. Equipment reliability and space qualification.

1. **Satellite link design (9 hours)**
   1. Basic transmission Theory,
   2. System noise temperature and G/T ratio,
   3. Design of downlinks,
   4. Satellite systems using small earth stations Uplink design,
   5. Design for C/N:Combining C/N and C/I values in satellite links,
   6. System design examples

1. **Multiple access techniques for satellite links (4 hours)**
   1. Multiple access
   2. Frequency Division Multiple Access
   3. Time Division Multiple Access
   4. On board processing
   5. Demand access Multiple Access
   6. Random access
   7. Code division Multiple Access

1. **Propagation effects and their impact on satellite-earth links (3 hours)**
   1. Quantifying attenuation and depolarization
   2. Propagation effects that are not associated with hydrometers
   3. Rain and ice effects
   4. Prediction of rain attenuation
   5. Prediction of XPD
   6. Propagation impairment Countermeasures

1. **VSAT systems (4 hours)**
   1. Network architectures
   2. Access control protocol
   3. Basic techniques
   4. SAT earth station engineering
   5. Calculation of link margins for VSAT star network
   6. System design procedures

1. **Low Earth Orbit and Non-Geostationary Satellite systems(4 hours)**
   1. Orbit considerations
   2. Coverage and frequency considerations
   3. Delay and throughput considerations
   4. Operational NGSO constellation design
   5. Introduction to Satellite mobile network
   6. Meteorological Satellites System

1. **Direct broadcast Satellite TV and radio (4 hours)**
   1. C-Band and Ku band home satellite TV
   2. Digital DBS–TV
   3. DBS–TV system design
   4. DBS–TV link budget
   5. Error control in digital DBS TV
   6. DBS –TV link budget
   7. Master control station and uplink
   8. Establishment of DBS–TV antennas Satellite radio broadcasting

1. **Satellite Navigation and Global Positioning System (5 hours)**
   1. Radio and Satellite navigation
   2. GPS position location principles
   3. GPS receivers and Codes
   4. Satellite signal acquisition
   5. GPS navigation message
   6. GPS signal levels
   7. Timing accuracy
   8. GPS receiver operation

**Practical/ Field visits**  
Field visits to Satellite Stations.

**References:**

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt,“Satellite Communications”, John Willy & Sons (Asia) Pvt. Ltd.
2. Dennis Roddy, “Satellite Communications”, McGraw-Hill Publication.
3. James Martyn, “Communication Satellite systems”, Prentice Hall.
4. Wilbur L. Pritchard, Hendri G. Suyderhoud and Robert A. Nelson, “SatelliteCommunication Systems Engineering”, Prentice Hall/Pearson.
5. M.Richharia, “Satellite Communication Systems-Design Principles”,Macmillan.
6. Emanuel Fthenakis, “Manual of Satellite Communications”, McGraw Hill Book Co.