Course Overview

Technical Introduction to Geostationary Satellite Communication Systems

Course Objective & Content

- Upon completion of this course, the student will understand the concepts, terminology and practical applications of satellite communications
- This course presents a technical introduction to Geostationary Satellite Communication Systems, with special emphasis on Earth Stations and Link Budgets
- Review quizzes and practical exercises during most sections, with a final test at the end of the course

Course Options

- This course can be taken in its entirety or customized to meet your specific needs
- The course length if taken in its entirety is approximately 100 hrs.
- Offered:
  - Virtual Instructor Led Training (VILT) - Web Based Training
  - Onsite Instructor Led Training (ILT)
  - Self Paced e-learning

Course
Intended Audience & Prerequisites

- An initial introduction to satellite communications for:
  - Sales Staff
  - Installers
  - Managers
- A more comprehensive course for:
  - Technicians
  - Engineers
  - Project Managers
- Prerequisites
  - An interest in satellite communications

Course Outline

1. Introduction
2. Communications Satellites
3. Satellite Communication Principles
4. Earth Stations
5. Link Analysis
6. Digital Video
7. IP over Satellite (IPoS)
8. Emerging Trends in Satellite Communications

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Course Outline

Section 1
Introduction

Course Outline
Introduction

- The introduction provides reference material in the form of discussions and handouts on several key concepts, principle technical terms, a glossary of terms, and a list of acronyms that will be used throughout the course.

Course Outline
Introduction

- **Class Introduction**
- **Principle Technical Terms**
  - Frequency, Wavelength and Propagation
  - Polarization
  - Power (in Watts)
  - The Decibel (dB)
  - Noise (C/N etc.)
  - Gain to Noise Temperature Ratio (G/T)
  - Effective Isotropic Radiated Power (EIRP)
  - Power and Saturating Flux Density (PFD and SFD)
  - Bandwidth (BW)
  - Bit Error Rate (BER)

Course Outline

Section 2
Communications Satellites

Course Outline
Communications Satellites

- In this section satellites and the satellite concepts are introduced. After a brief look at various uses of satellites, focus moves to communications. Typical satellite design features are discussed, along with testing and performance verification procedures.

Course Outline
Communications Satellites

- Types of Commercial Satellites
- Satellite Systems
- Satellite Payloads
- Satellite Bus and Platform Subsystems
- Product Assurance
- Reliability Considerations
- Design and Performance Verification

Course Outline

Section 3
Satellite Communication Principles

Course Outline
Satellite Communication Principles

- This section discusses how we use satellites. Various satellite system topologies are introduced, and methods of accessing satellite resources from the ground are established. Important technical concepts are dealt with in this section as well. Carrier modulation methods and error correction coding concepts are taught. As well, students will be introduced to various methods employed for dealing with the effects of satellite distance and motion.

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Course Outline
Satellite Communication Principles

- Typical Satellite System Topologies
- Frequency Reuse Schemes
- Carrier Access Schemes
- Modulation Techniques
- Processing Digital and Analog Signals
- Effects of Delay and Motion

Course Outline

Section 4
Earth Stations

Course Outline
Earth Stations

- Probably the most important section for the student of this course. In it we cover Earth Station design, installation, operation and maintenance. Numerous types and sizes of earth stations are discussed, along with interfacing techniques. Students will profit, in particular, from the detailed discussions of a typical Earth Station with its emphasis on setup, testing, and fault finding.

Course Outline
Earth Stations

- Types of Earth Station
- Earth Station Design Objectives
- Site Selection
- How Users Interface with an Earth Station
- Earth Station Block Diagram Review
- Commissioning (Antenna Alignment etc.)
- Earth Station Maintenance
- Failure Modes and Troubleshooting Techniques
- RF Safety
- Power Distribution

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Course Outline

Section 5
Link Analysis

Course Outline
Link Analysis

- We've dealt with satellites in orbit and with Earth Stations on the ground, now it's time to connect the two. This section deals with designing satellite communication links. The engineering model of a satellite link is introduced, followed by discussions of propagation, noise, and other factors that affect the link. Detailed link calculations will be made on example links, and students will be given the opportunity to design their own link solution.

Course Outline
Link Analysis

- Getting Started
- The Satellite Link
- Calculating a Link Budget

Course Outline

Section 6
Digital Video

Course Outline
Digital Video

- Digital video is a big part of every satellite provider's business. This section will take the student from analog to digital video, from uncompressed to compressed digital video streams, and will introduce common standards. Having introduced digital video itself, the course will then turn to Digital Video Broadcasting (DVB) where methods for handling digital data streams over satellite will be discussed. Finally, new digital video standards will be mentioned (S1, S2, ACM etc), with emphasis on broadband services.

Course Outline
Digital Video

- Analog Video
- Digitization of Video
- MPEG
- International Standards
- Digital Video Broadcasting (DVB)
- ATSC
- HDTV
- Hardware Description and Service Troubleshooting
- Other MPEG / Compression Standards (MPEG 4 etc.)
- Other DVB Standards (S1, S2, ACM etc.)
- Digital Satellite News Gathering

Course Outline
IP over Satellite (IPoS)

- Students will be introduced to the fundamentals of IPoS. With special emphasis on optimization and acceleration techniques to overcome the inherent latency issues associated with IPoS. The IPoS system delivers “always on” service and is targeted at residential, SOHO and enterprise markets. The primary services offered to these segments are broadband Internet access and WAN. Additionally services such as audio/video streaming, VoIP/QoS will be introduced.

Course Outline
IP over Satellite (IPoS)

- IPoS Overview
- Satellite Latency
- Protocols
- TCP Acceleration for Satellite Links
- Security Considerations
- VPN's
- Broadband Network Optimization
- VoIP / QoS
- IPTV

Course Outline

Section 8
Emerging Trends in Satellite Communications

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Course Outline
Emerging Trends in Satellite Communications

- The final section deals with the future. What new technologies and market forces are driving the design of communication satellites today? Students will be introduced to regenerative processing, new frequency bands, inter-satellite links, and upcoming changes in satellite roles. Some global coverage schemes, both already in the sky and still on paper, will be mentioned.

Course Outline
Emerging Trends in Satellite Communications

- Satellite Communication
- Systems and Services

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