GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161010
Semester – VI
Subject Name: Satellite Communication

Type of course:

Prerequisite: Analog and Digital Communication, Microwave Engineering

Rationale: The students need to learn basic concepts of satellite communication, components of satellite systems, Advantages and disadvantages of Satellite systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Satellite Communication**: Principles and architecture of satellite communication, Brief history of satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.	4
2	**Orbital Mechanics:** Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.	9
3	**Satellite sub-systems:** Study of architecture and roles of various sub-systems of a satellite system such as Telemetry, tracking , command and monitoring (TTC&M),Attitude and orbit control system (AOCS),Communication sub-system, power sub-system etc.	8
4	**Typical Phenomena in Satellite Communication:** Solar Eclipse on satellite, its effects, remedies for eclipse, sun transit outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.	4
5	**Satellite link budget:** Flux density and received signal power equations, Calculation of system noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clean air and rainy conditions.	10

6	**Modulation and Multiple Access Schemes:** Various modulation schemes used in satellite communication, Meaning of multiple access, Multiple access schemes based on time, frequency and code sharing namely TDMA, FDMA and CDMA.	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**10**	**10**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Timothy Pratt, Charles W.Bostian, Jeremy E Allnutt: Satellite Communications: Wiley India
2. Dennis Roddy: Satellite Communication: McGraw Hill

Course Outcomes:

After learning the course, the students should be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Visualize the architecture of satellite systems as a means of high speed, high range communication system	20
CO-2	State various aspects related to satellite systems such as orbital equations, subsystems in a satellite, link budget, modulation and multiple access schemes	40
CO-3	Solve numerical problems related to orbital motion and design of link budget the given parameters and conditions	40

List of Experiments:

Sr.No.	**Experiment Title**
1.	Understanding the basic concepts of satellite communication
2.	To setup a communication link between uplink transmitter and downlink receiver using Satellite
3.	To setup an Active satellite communication link and demonstrate link fail operation
4.	To communicate voice & Video signal through satellite link

5.	Observe the effect of Different combinations of uplink and downlink frequencies on satellite link
6.	To transmit and receive three separate signals (Audio, Video , Tone) simultaneously through satellite link
7.	To transmit and receive function generator signals through satellite link
8.	To measure the signal parameters in an analog FM/FDM TV satellite link
9.	To transmit digital waveforms through a satellite communication link
10.	To Calculate Bit Error Rate in a satellite communication link