



# 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
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs
1	<b>Introduction to Satellite Communication:</b> Principles and architecture of satellite communication, Brief history of satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.	4
2	<b>Orbital Mechanics:</b> 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	<b>Satellite sub-systems:</b> 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	<b>Typical Phenomena in Satellite Communication:</b> 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	<b>Satellite link budget:</b> 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



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<b>6</b>	<b>Modulation and Multiple Access Schemes:</b> 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
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**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>20</b>	<b>20</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>

**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 Allnut: 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



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