Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - VI EXAMINATION - WINTER 2025

Subject Code: 3161010 **Date: 25-11-2025**

Subject Name: Satellite Communication

Time: 02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define satellite communication. What is its basic principle?	**03**
	(b)	Write a short note on the frequency bands (L, C, Ku, Ka) used in satellite systems and their significance.	**04**
	(c)	Compare the advantages and disadvantages of satellite communication with that of microwave terrestrial systems.	**07**
Q.2	**(a)**	State Kepler's three laws of planetary motion and mention their significance in satellite motion.	**03**
	(b)	Derive the expression for orbital period using Kepler's third law.	**04**
	(c)	With a neat diagram, explain semi-major axis, right ascension of the ascending node (Ω), the argument of perigees (ω), inclination, eccentricity, and true anomaly in an elliptical orbit.	**07**
		OR	
	(c)	Explain in detail the difference between solar day and sidereal day and how it affects satellite ground track patterns.	**07**
Q.3	**(a)**	List the main subsystems of a typical communication satellite.	**03**
	(b)	Describe the energy generation, storage, and distribution process in the satellite power subsystem.	**04**
	(c)	Explain in detail the Telemetry, Tracking, Command, and Monitoring (TTC&M) subsystem with a neat block diagram and functions of each unit.	**07**
		OR	
	(a)	Mention the major functions of a communication subsystem.	**03**
	(b)	Describe how thermal control is achieved in satellite subsystems.	**04**
	(c)	Discuss the Attitude and Orbit Control System (AOCS) in detail — describe sensors, actuators, and control mechanisms used for orientation and orbit correction.	**07**
Q.4	**(a)**	What is a solar eclipse on a satellite? Explain with figure.	**03**
	(b)	Describe the sequence of events during a sun transit outage and its effect on signal quality.	**04**

	(c)	Compare the impact of Doppler shift on GEO, MEO, and LEO satellite systems, and explain the compensation techniques used.	**07**

OR

	(a)	Define flux density in the context of satellite communication.	**03**
	(b)	Explain how system noise temperature of a receiver is calculated using individual component noise figures.	**04**
	(c)	Explain in detail the steps for preparing a satellite link budget, highlighting uplink and downlink power calculations and link margins.	**07**
Q.5	**(a)**	Define C/N ratio and explain its importance in satellite link design.	**03**
	(b)	Explain how rain attenuation affects the C/N ratio of a satellite link and how it is compensated.	**04**
	(c)	A satellite transponder uses TDMA to serve multiple earth stations. Explain the timing, synchronization, and guard time concepts involved in the system design.	**07**

OR

	(a)	Define multiple access and explain its necessity in satellite communication.	**03**
	(b)	Compare Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), and Phase Shift Keying (PSK) in terms of bandwidth and power efficiency.	**04**
	(c)	Compare TDMA, FDMA, and CDMA on the basis of channel allocation, synchronization, interference, and system capacity.	**07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024

Subject Code:3161010 Date:05-12-2024

Subject Name:Satellite Communication

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define: Prograde orbit, retrograde orbit, Mean anomaly	**03**
	(b)	Define: True anomaly, Argument of perigee, Apogee, Perigee	**04**
	(c)	Describe: (1) Kepler's first law with figure. (2) Kepler's Second law with figure.	**07**
Q.2	**(a)**	Describe Kepler's Third law.	**03**
	(b)	Define: (1) Ascending node. (2) Descending node (3) Line of Nodes (4) Inclination	**04**
	(c)	Describe: Feeder losses and antenna misalignment losses with figures.	**07**
		OR	
	(c)	Explain preassigned FDMA in detail.	**07**
Q.3	**(a)**	What are the conditions required for an orbit to be geostationary?	**03**
	(b)	Show the table containing different frequency bands (used with satellite communication) along with Band designation.	**04**
	(c)	Describe Noise temperature of absorptive networks and show that the noise factor of a lossy network is equal to its power loss.	**07**
		OR	
Q.3	**(a)**	Define: equivalent isotropic radiated power.	**03**
	(b)	Explain the term: Station keeping.	**04**
	(c)	With diagram Explain the overall system noise temperature and write its equation. Also derive the equation for carrier to Noise ratio.	**07**
Q.4	**(a)**	Explain sun Transit outage.	**03**
	(b)	Calculate the apogee and Perigee heights for the orbital parameters e=0.0011501, a=7192.335 km and mean earth radius=6371 km.	**04**
	(c)	Draw the complete satellite circuit which includes combined uplink and downlink. Derive the equation for combined Noise-to-carrier ratio N_0/C.	**07**
		OR	
Q.4	**(a)**	Calculate the radius of a circular orbit for which the period is one day.	**03**
	(b)	What are the advantages of satellite communication systems?	**04**
	(c)	The apogee and perigee distance of a satellite orbiting in an elliptical orbit are respectively 45000 km and 7000 km.Determine the following: (1) Semi-major axis of the elliptical orbit. (2) Orbital eccentricity	**07**

(3) Distance between the center of the earth and the center of elliptical orbit.

Q.5	**(a)**	Define Direct sequence Spread Spectrum.	**03**
	(b)	Explain Preassigned TDMA with diagram.	**04**
	(c)	Explain satellite switched TDMA with diagram.	**07**
		OR	
Q.5	**(a)**	Explain the space segment.	**03**
	(b)	With diagram explain the function of basic CDMA system.	**04**
	(c)	Illustrate the basic TDMA concept in which the stations transmit bursts in sequence. Draw necessary figures.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2023

Subject Code:3161010 Date:13-12-2023

Subject Name: Satellite Communication

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Describe polar orbiting satellites with figure.	**03**
	(b)	Describe briefly any four services provided by satellite	**04**
	(c)	Define: (1) Kepler's first law with figure. (2) Kepler's Second law with figure.	**07**
Q.2	**(a)**	Describe Kepler's Third law.	**03**
	(b)	Define: (1) subsatellite path. (2) Apogee (3) Perigee (4) Line of apsides	**04**
	(c)	Explain Orbit perturbations and Effects of a nonspherical earth With necessary equations.	**07**
		OR	
	(c)	Explain earth eclipse of satellite with figure.	**07**
Q.3	**(a)**	What are the conditions required for an orbit to be geostationary?	**03**
	(b)	Explain limits of visibility with figure.	**04**
	(c)	Describe with figure: The attitude control in detail.	**07**
		OR	
Q.3	**(a)**	What do you mean by near geostationary orbit?	**03**
	(b)	Explain the term: Station keeping.	**04**
	(c)	With diagram Explain the TT&C Subsystem in detail.	**07**
Q.4	**(a)**	Explain sun Transit outage.	**03**
	(b)	Calculate the apogee and Perigee heights for the orbital parameters e=0.0011501, a=7192.335 km and mean earth radius=6371 km.	**04**
	(c)	Derive the equation for Carrier to Noise ratio(C/N_o) at receiver input.	**07**
		OR	
Q.4	**(a)**	Define: (1) Ascending node (2) descending node (3) Line of Nodes.	**03**
	(b)	Define Equivalent Isotropic Radiated Power (EIRP) with equation.	**04**
	(c)	Describe preassigned FDMA with diagram.	**07**
Q.5	**(a)**	Explain Demand assigned FDMA.	**03**
	(b)	What is link power budget equation? Explain briefly.	**04**
	(c)	Describe the Noise temperature of absorptive networks with necessary equations and derive the equation for Overall system noise temperature.	**07**
		OR	
Q.5	**(a)**	Describe: Demand assigned TDMA.	**03**
	(b)	With diagram explain the function a basic CDMA system.	**04**
	(c)	Describe: Preassigned TDMA with figures.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI(NEW) EXAMINATION – WINTER 2022

Subject Code:3161010 Date:17-12-2022

Subject Name:Satellite Communication

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define following terms: (1) Apogee (2) Perigee (3) Line of apsides	**03**
	(b)	Draw and explain the block diagram of satellite communication in detail.	**04**
	(c)	Explain advantages of satellite communication over terrestrial communication.	**07**
Q.2	**(a)**	What is sun synchronous orbit?	**03**
	(b)	List the orbital elements and explain each of them in detail.	**04**
	(c)	Explain three laws of Kepler's for planetary motion in detail.	**07**
		OR	
	(c)	Give comparison of LEO, MEO and GEO satellite orbits and gives application also.	**07**
Q.3	**(a)**	What is station keeping?	**03**
	(b)	Briefly describe the three-axis method of satellite stabilization.	**04**
	(c)	Draw and explain block diagram of TT & C system for communication satellite.	**07**
		OR	
Q.3	**(a)**	Give the difference between Attitude control and Orbital Control.	**03**
	(b)	Write short note on Satellite Antennas.	**04**
	(c)	Explain Single conversion transponder and Double conversion transponder in detail.	**07**
Q.4	**(a)**	Define following terms. (1) Noise factor (2) Noise Temperature (3) Carrier to Noise ratio	**03**
	(b)	Explain various uplink path losses in satellite communication.	**04**
	(c)	Explain how to compute uplink and downlink C/N ratios for a typical satellite link.	**07**
		OR	
Q.4	**(a)**	What is EIRP? Show the relationship between Power flux density and EIRP.	**03**
	(b)	Derive Friis transmission equation for received power in any radio link.	**04**
	(c)	Define Downlink. Draw a pictorial representation of a Downlink. Show the power budget calculations for a downlink path.	**07**
Q.5	**(a)**	What is CBTR (Carrier and bit time recovery)?	**03**
	(b)	List the advantage and disadvantage of FDMA, TDMA and CDMA.	**04**
	(c)	Explain briefly code division multiple access.	**07**
		OR	
Q.5	**(a)**	Compare FDM/FM-FDMA and SCPC-FDMA	**03**

(b) Give the difference between Multiplexing techniques and Multiple access techniques. **04**

(c) Explain the SPADE system. **07**

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