Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code:3161010 Date:30-05-2025

Subject Name:Satellite Communication

Time:10:30 AM TO 01:00 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: (1) Sub satellite path (2) Retrograde Orbit (3) Inclination	**03**
	(b)	Describe various types of services provided by the satellite and also show the Frequency band designations.	**04**
	(c)	Describe the different types of orbits used for satellite communication with necessary figures.	**07**
Q.2	**(a)**	Define: (1) Mean Anomaly (2) true anomaly (3) Prograde Orbit	**03**
	(b)	Explain Apogee Height and perigee height with necessary equations.	**04**
	(c)	Explain Three laws of Kepler for planetary motion with figures.	**07**
		OR	
	(c)	What are the orbit perturbations? Explain the Effect of Non-spherical Earth with necessary equations.	**07**
Q.3	**(a)**	What are the conditions required for an orbit to be geostationary?	**03**
	(b)	What do you mean by The space segment and the satellite equipments? Explain in detail.	**04**
	(c)	Draw and explain the block diagram of satellite transponder in detail.	**07**
		OR	
Q.3	**(a)**	With necessary diagram explain: Spinning satellite Stabilization.	**03**
	(b)	Explain the term: Station keeping.	**04**
	(c)	What is the three axis stabilization? Explain with the help of suitable diagram. What are the advantages and disadvantages of three axis stabilization?	**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)	Write a short note on attitude control system..	**07**
		OR	
Q.4	**(a)**	Calculate the free space loss for a satellite at 42000 km from an earth station, if the signal frequency is 6 GHz.	**03**
	(b)	Explain the concept of Doppler shift with necessary equations.	**04**
	(c)	Explain the DSSS-CDMA for satellite communication with necessary diagrams.	**07**
Q.5	**(a)**	What are the advantages and disadvantages of Demand assigned FDMA?	**03**
	(b)	What is link power budget equation? Explain briefly.	**04**
	(c)	With diagram explain : SPADE System	**07**

OR

Q.5	**(a)**	Describe the merits of Demand assigned TDMA system.	**03**
	(b)	A satellite stationed at a distance 38000 km from the surface of earth radiates a power of 3 watts, in the direction of an earth station .Assuming the satellite antenna gain to be 20dB, calculate the flux density at the earth station and the power received by the antenna of an effective area 8m.	**04**
	(c)	Describe: Satellite switched TDMA with figures.	**07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3161010 Date:24-05-2024

Subject Name:Satellite Communication

Time:10:30 AM TO 01:00 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)**	Explain the principles and architecture of satellite communication. How do satellites function as key components in the communication system?	**03**
	(b)	Explore the different frequency bands used for satellite communication. Discuss the reasons behind using specific frequency bands.	**04**
	(c)	Explore the various applications of satellite communication across different sectors, including telecommunications, broadcasting, remote sensing, and navigation. Explain the impact of satellite technology on these domains and its significance in today's world.	**07**
Q.2	**(a)**	Define the terms apogee and perigee in the context of satellite orbits. How are they different for elliptical orbits, and what is their significance?	**03**
	(b)	Calculate the orbital period of a satellite in a given orbit. Explain the factors that influence the orbital period and its importance in satellite design and positioning.	**04**
	(c)	Provide a detailed explanation of Kepler's laws and their relevance to satellite orbits. How do these laws describe the motion of satellites and help in predicting their positions in space?	**07**
		OR	
	(c)	Compare and contrast the concepts of a solar day and a sidereal day. Explain how these different time measurements relate to satellite orbit determination and synchronization with ground stations.	**07**
Q.3	**(a)**	Describe the importance and functions of the Attitude and Orbit Control System (AOCS) in a satellite. How does AOCS ensure the satellite's proper orientation and positioning in space?	**03**
	(b)	Explain the significance of the Power sub-system in a satellite. How is power generated, stored, and distributed on a satellite, and what factors influence the choice of power sources and storage methods?	**04**
	(c)	Define and explain the roles of Telemetry, Tracking, Command, and Monitoring (TTC&M) subsystems in a satellite system. How do these subsystems contribute to the successful operation of a satellite?	**07**
		OR	
Q.3	**(a)**	What is station keeping?	**03**
	(b)	Write short note on Satellite Antennas.	**04**
	(c)	Draw the block diagram of the satellite Transponder. Explain frequency reuse in transponders.	**07**

Q.4	**(a)**	Describe the phenomenon of a solar eclipse on a satellite. How does a solar eclipse affect satellite communication, and what challenges does it pose?	**03**
	(b)	Explain the concept of sun transit outage phenomena in satellite communication. What are the effects of sun transit outages, and how can they be mitigated?	**04**
	(c)	Discuss the importance of Carrier-to-Noise (C/N) ratio calculations in both clean air and rainy conditions. Explain how variations in weather and atmospheric conditions can affect the C/N ratio and signal quality in satellite communication.	**07**

OR

Q.4	**(a)**	Explain the concept of flux density in satellite communication. How is received signal power calculated based on flux density and antenna characteristics?	**03**
	(b)	Describe the significance of system noise temperature in a satellite receiver. How is system noise temperature calculated, and how does it impact the overall performance of the receiver?	**04**
	(c)	Describe the process of drafting a satellite link budget in detail. Include all the major factors that need to be considered, such as transmit power, path loss, antenna gains, and noise temperature. How is the link budget used to ensure reliable communication in different weather conditions?	**07**
Q.5	**(a)**	What is EIRP? Show the relationship between Power flux density and EIRP.	**03**
	(b)	Define following terms: (1) Inclination (2) Semi-major axis (3) Prograde orbit (4) Footprint	**04**
	(c)	Explain the SPADE system.	**07**

OR

Q.5	**(a)**	Define multiple access in satellite communication. What does it mean, and why is it a critical aspect of satellite network design and operation?	**03**
	(b)	Explain briefly code division multiple access.	**04**
	(c)	Compare and contrast the Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), and Code Division Multiple Access (CDMA) schemes used in satellite communication. How do these multiple access methods differ in their approach and suitability for various scenarios?	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3161010 Date:14-07-2023

Subject Name:Satellite Communication

Time:10:30 AM TO 01:00 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)**	What are the advantages of satellite communication?	**03**
	(b)	Explain the architecture of a satellite communication system.	**04**
	(c)	Compare and contrast the different frequency bands used for satellite communication and their applications.	**07**
Q.2	**(a)**	What is the difference between a solar day and a sidereal day?	**03**
	(b)	Define Inclination, Prograde orbit, Argument of perigee, Right ascension of ascending node.	**04**
	(c)	State Kepler's three laws of planetary motion with figures and equations.	**07**
		OR	
	(c)	Explain the concept of a geostationary orbit and its significance in satellite communication.	**07**
Q.3	**(a)**	What is the purpose of the attitude and orbit control system in a satellite?	**03**
	(b)	Discuss the functions of the Telemetry, Tracking, Command and Monitoring (TTC&M) subsystem in a satellite.	**04**
	(c)	Analyze the power sub-system of a satellite and explain the methods used for power generation and storage in a satellite.	**07**
		OR	
Q.3	**(a)**	What is the sun transit outage phenomenon and its effect on satellite communication?	**03**
	(b)	Briefly describe the three-axis method of satellite stabilization.	**04**
	(c)	Explain the block diagram of Satellite Transponder. Also explain the frequency reuse technique for Transponder.	**07**
Q.4	**(a)**	What is a satellite link budget in satellite communication?	**03**
	(b)	Explain the received signal power equation used in satellite link budget calculations.	**04**
	(c)	Discuss the advantages and disadvantages of each multiple access scheme, and suggest situations where each would be most appropriate in satellite communication.	**07**
		OR	

Q.4	**(a)**	What is the meaning of multiple access?	**03**
	(b)	What is meant by space division multiple access?	**04**
	(c)	List the types of Multiple Access Scheme used in the satellite communication and give its comparisons.	**07**
Q.5	**(a)**	What is SCPC?	**03**
	(b)	Analyze the time division multiple access (TDMA) technique used in satellite communication and discuss its applications.	**04**
	(c)	Discuss the impact of weather conditions on the satellite link budget and C/N ratio calculations.	**07**

OR

Q.5	**(a)**	Discuss the applications of satellite communication in military, broadcast, and remote sensing.	**03**
	(b)	Describe the brief history of satellite systems in satellite communication.	**04**
	(c)	Analyze the impact of satellite communication on global communication systems and the future prospects of the technology.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3161010 Date:10/06/2022

Subject Name:Satellite Communication

Time:10:30 AM TO 01:00 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)**	Define (1) Apogee (2) Perigee (3) Subsetellite Path	**03**
	(b)	State Kepler's three laws of planetary motion.	**04**
	(c)	Explain various frequency bands used for satellite communication.	**07**
Q.2	**(a)**	Define Earth Eclipse of Satellite.	**03**
	(b)	Explain Attitude & Orbit Control system (AOCS).	**04**
	(c)	Draw and Explain block diagram of TTC & M system.	**07**
		OR	
	(c)	Briefly describe the Three axis method of satellite stabilization.	**07**
Q.3	**(a)**	Define the terms Roll, pitch and yaw.	**03**
	(b)	Explain the Effect of a nonspherical earth on orbital path of satellite.	**04**
	(c)	Draw & Explain block diagram of Transponder.	**07**
		OR	
Q.3	**(a)**	Define the following : (1) Atmospheric drag. (2) Doppler Shift.	**03**
	(b)	Explain what is meant by EIRP.	**04**
	(c)	What is the advantage of TWTA used aboard the satellites.	**07**
Q.4	**(a)**	Calculate the radius of a circular orbit for which the period is 1 day.	**03**
	(b)	Derive Friis transmission equation for received power in any radio link.	**04**
	(c)	Compare FDMA, TDMA and CDMA techniques.	**07**
		OR	
Q.4	**(a)**	Define elevation angle and azimuth angle.	**03**
	(b)	A geostationary satellite is located at 90^0 W. Calculate the azimuth angle for an earth-station antenna at latitude 35^0 N and longitude 100^0 W.	**04**
	(c)	Discuss the various design issues related with uplink design and give the Expression C/N ratio for the same.	**07**
Q.5	**(a)**	What is Demand Assigned FDMA.	**03**
	(b)	Explain Noise Power Calculation in Satellite Link Budget.	**04**
	(c)	Explain Sun transit outage phenomena.	**07**
		OR	
Q.5	**(a)**	What is SPADE System in channeling scheme.	**03**
	(b)	Explain Various modulation schemes used in satellite communication.	**04**
	(c)	Explain C/N ratio calculations in clean air and rainy conditions.	**07**

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