GUJARAT TECHNOLOGICAL UNIVERSITY

BE-6 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code:

SATELLITE COMMUNICATION (3161010)

Unit 1: Introduction to Satellite Communication

Repeated Questions:

1. **Explain/Describe the advantages of satellite communication.**
   (S25 - Q1a, 03 marks)
   (W24 - Q4b, 04 marks)
   (W22 - Q1c, 07 marks)
2. **Explain/Describe the different frequency bands used for satellite communication.**
   (W25 - Q1b, 07 marks)
   (S25 - Q1c, 07 marks)
   (S24 - Q1c, 07 marks)
   (S22 - Q1c, 07 marks)
3. **Define Apogee and Perigee.**
   (W25 - Q1a, 03 marks)
   (S24 - Q2a, 03 marks)
   (W22 - Q1a, 03 marks)
   (W23 - Q2b, 04 marks)
   (S22 - Q1a, 03 marks)

Other Important Questions (Newest to Oldest):

1. **Define satellite communication. What is its basic principle?** (W25 - Q1a, 03 marks)
2. **Compare the advantages and disadvantages of satellite communication with that of microwave terrestrial systems.** (W25 - Q1c, 07 marks)
3. **Explain the principles and architecture of satellite communication. How do satellites function as key components in the communication system?** (S24 - Q1a, 07 marks)
4. **Explore the various applications of satellite communication across different sectors...** (S24 - Q1c, 07 marks)
5. **Brief history of satellite systems in satellite communication.** (S23 - Q5b, 04 marks)
6. **Analyze the impact of satellite communication on global communication systems and the future prospects of the technology.** (S23 - Q5c, 07 marks)
7. **Describe various types of services provided by the satellite and also show the Frequency band designations.** (S22 - Q1b, 04 marks)
8. **Describe briefly any four services provided by satellite.** (W23 - Q1b, 04 marks)
9. **Describe polar orbiting satellites with figure.** (W23 - Q1a, 03 marks) [Figure given - refer Question paper of W23]
10. **Define: (1) Sub satellite path (2) Retrograde Orbit (3) Inclination.** (S22 - Q1a, 03 marks)
11. **Define: Prograde orbit, retrograde orbit, Mean anomaly.** (W24 - Q1a, 03 marks)
12. **Draw and explain the block diagram of satellite communication in detail.** (W22 - Q1b, 04 marks) [Figure given - refer Question paper of W22]

Unit 2: Orbital Mechanics

Repeated Questions:

1. **State/Explain Kepler's three laws of planetary motion.**
   (W25 - Q2a, 03 marks)
   (S25 - Q2c, 07 marks)
   (S24 - Q2c, 07 marks)
   (W22 - Q2c, 07 marks)
   (W23 - Q1c(1&2), 07 marks)
   (W24 - Q1c(1&2), 07 marks)
   (S22 - Q1b, 04 marks)
2. **What is the difference between a solar day and a sidereal day? / Compare and contrast solar day and sidereal day.**
   (W25 - Q2 OR(c), 07 marks)
   (S25 - Q2a, 03 marks)
   (S24 - Q2 OR(c), 07 marks)
3. **Define/Explain: Inclination, Argument of Perigee, Right Ascension of Ascending Node (Ω).**
   (W25 - Q2c, 07 marks)
   (S25 - Q2b, 04 marks)
   (W24 - Q1b, 04 marks)
   (W24 - Q2b, 04 marks)
4. **Explain the concept of a geostationary orbit and its significance.**
   (S25 - Q2 OR(c), 07 marks)
   (W23 - Q3a, 03 marks)
   (S22 - Q3a, 03 marks)
   (W24 - Q3a, 03 marks)
5. **Calculate the apogee and perigee heights for given orbital parameters (e=0.0011501, a=7192.335 km, Earth radius=6371 km).**
   (W23 - Q4b, 07 marks)
   (S22 - Q4b, 07 marks)
   (W24 - Q4b, 07 marks)

Other Important Questions (Newest to Oldest):

1. **Derive the expression for orbital period using Kepler's third law.** (W25 - Q2b, 04 marks)
2. **With a neat diagram, explain semi-major axis, right ascension of the ascending node (Ω), the argument of perigee (ω), inclination, eccentricity, and true anomaly in an elliptical orbit.** (W25 - Q2c, 07 marks) [Figure given - refer Question paper of W25]
3. **Define the terms apogee and perigee in the context of satellite orbits...** (S24 - Q2a, 03 marks)
4. **Calculate the orbital period of a satellite in a given orbit...** (S24 - Q2b, 07 marks)
5. **List the orbital elements and explain each of them in detail.** (W22 - Q2b, 04 marks)
6. **Give comparison of LEO, MEO and GEO satellite orbits and gives application also.** (W22 - Q2 OR(c), 07 marks)
7. **Define: (1) Mean Anomaly (2) true anomaly (3) Prograde Orbit.** (S22 - Q2a, 03 marks)
8. **Explain Apogee Height and perigee height with necessary equations.** (S22 - Q2b, 04 marks)
9. **What are the orbit perturbations? Explain the Effect of Non-spherical Earth with necessary equations.** (S22 - Q2 OR(c), 07 marks)
10. **Describe Kepler's Third law.** (W23 - Q2a, 03 marks)
11. **Define: (1) subsatellite path. (2) Apogee (3) Perigee (4) Line of apsides.** (W23 - Q2b, 04 marks)
12. **Explain Orbit perturbations and Effects of a nonspherical earth With necessary equations.** (W23 - Q2c, 07 marks)
13. **Explain earth eclipse of satellite with figure.** (W23 - Q2 OR(c), 07 marks) [Figure given -

refer Question paper of W23]

14. **Define: (1) Ascending node (2) descending node (3) Line of Nodes.** (W24 - Q2b, 04 marks)
15. **Calculate the radius of a circular orbit for which the period is one day.** (W24 - Q4 OR(a), 03 marks)
16. **The apogee and perigee distance of a satellite orbiting in an elliptical orbit are respectively 45000 km and 7000 km. Determine: (1) Semi-major axis, (2) Orbital eccentricity, (3) Distance between the center of the earth and the center of elliptical orbit.** (W24 - Q4 OR(c), 07 marks)
17. **Define: (1) Line of apsides.** (W22 - Q1a, 03 marks)
18. **What is sun synchronous orbit?** (W22 - Q2a, 03 marks)
19. **Define Earth Eclipse of Satellite.** (S22 - Q2a, 03 marks)

Unit 3: Satellite Sub-systems

Repeated Questions:

1. **Explain the Telemetry, Tracking, Command and Monitoring (TTC&M) subsystem.**
   (W25 - Q3c, 07 marks)
   (S25 - Q3b, 04 marks)
   (W22 - Q3c, 07 marks)
   (W23 - Q3c, 07 marks)
2. **Explain/Describe the Attitude and Orbit Control System (AOCS).**
   (W25 - Q3 OR(c), 07 marks)
   (S25 - Q3a, 03 marks)
   (S24 - Q3a, 07 marks)
   (S22 - Q2b, 04 marks)
3. **Explain the Power sub-system (generation, storage, distribution).**
   (W25 - Q3b, 04 marks)
   (S25 - Q3c, 07 marks)
   (S24 - Q3b, 07 marks)
4. **What is station keeping?**
   (S24 - Q3 OR(a), 03 marks)
   (W22 - Q3a, 03 marks)
   (W23 - Q3b, 04 marks)
   (W24 - Q3b, 04 marks)
5. **Briefly describe/Explain the three-axis method of satellite stabilization.**
   (S23 - Q3b, 04 marks)
   (W22 - Q3b, 04 marks)
   (S22 - Q2 OR(c), 07 marks)
6. **Draw and explain the block diagram of a Satellite Transponder.**
   (S23 - Q3c, 07 marks)
   (S24 - Q3 OR(c), 07 marks)
   (W22 - Q3 OR(c), 07 marks)
   (S22 - Q3c, 07 marks)

Other Important Questions (Newest to Oldest):

1. **List the main subsystems of a typical communication satellite.** (W25 - Q3a, 03 marks)
2. **Describe how thermal control is achieved in satellite subsystems.** (W25 - Q3 OR(b), 04 marks)
3. **Mention the major functions of a communication subsystem.** (W25 - Q3 OR(a), 03 marks)
4. **Analyze the power sub-system of a satellite and explain the methods used for power generation and storage in a satellite.** (S25 - Q3c, 07 marks)
5. **Explain the block diagram of Satellite Transponder. Also explain the frequency reuse technique for Transponder.** (S23 - Q3c, 07 marks) [Figure given - refer Question paper of S23]
6. **What do you mean by The space segment and the satellite equipments? Explain in detail.** (S22 - Q3b, 04 marks)
7. **With necessary diagram explain: Spinning satellite Stabilization.** (S22 - Q3 OR(a), 03 marks) [Figure given - refer Question paper of S22]
8. **What is the three axis stabilization? Explain with the help of suitable diagram. What are the advantages and disadvantages of three axis stabilization?** (S22 - Q3 OR(c), 07 marks) [Figure given - refer Question paper of S22]
9. **Explain limits of visibility with figure.** (W23 - Q3b, 04 marks) [Figure given - refer Question paper of W23]
10. **Describe with figure: The attitude control in detail.** (W23 - Q3c, 07 marks) [Figure given - refer Question paper of W23]
11. **What do you mean by near geostationary orbit?** (W23 - Q3 OR(a), 03 marks)
12. **Give the difference between Attitude control and Orbital Control.** (W22 - Q3 OR(a), 03

marks)

13. **Write short note on Satellite Antennas.** (W22 - Q3 OR(b), 04 marks)
14. **Explain Single conversion transponder and Double conversion transponder in detail.** (W22 - Q3 OR(c), 07 marks)
15. **Define the terms Roll, pitch and yaw.** (S22 - Q3a, 03 marks)
16. **Explain the Effect of a nonspherical earth on orbital path of satellite.** (S22 - Q3b, 04 marks)
17. **Define the following : (1) Atmospheric drag. (2) Doppler Shift.** (S22 - Q3 OR(a), 03 marks)
18. **What is the advantage of TWTA used aboard the satellites.** (S22 - Q3 OR(c), 07 marks)
19. **Show the table containing different frequency bands (used with satellite communication) along with Band designation.** (W24 - Q3b, 04 marks) [Table given - refer Question paper of W24]
20. **Explain the space segment.** (W24 - Q5 OR(a), 03 marks)

Unit 4: Typical Phenomena in Satellite Communication

Repeated Questions:

1. **Explain sun transit outage.**
   (W25 - Q4b, 04 marks)
   (S23 - Q3a, 03 marks)
   (S22 - Q4a, 03 marks)
   (W23 - Q4a, 03 marks)
   (W24 - Q4a, 03 marks)
2. **What is a solar eclipse on a satellite? Explain with figure.**
   (W25 - Q4a, 03 marks)
   (S24 - Q4a, 03 marks)

Other Important Questions (Newest to Oldest):

1. **Compare the impact of Doppler shift on GEO, MEO, and LEO satellite systems, and explain the compensation techniques used.** (W25 - Q4c, 07 marks)
2. **Describe the sequence of events during a sun transit outage and its effect on signal quality.** (W25 - Q4b, 04 marks)
3. **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?** (S24 - Q4b, 07 marks)
4. **Describe the phenomenon of a solar eclipse on a satellite. How does a solar eclipse affect satellite communication, and what challenges does it pose?** (S24 - Q4a, 03 marks)
5. **Describe: Feeder losses and antenna misalignment losses with figures.** (W24 - Q2c, 07 marks) [Figure given - refer Question paper of W24]
6. **Explain the concept of Doppler shift with necessary equations.** (S22 - Q4b, 04 marks)

Unit 5: Satellite Link Budget

Repeated Questions:

1. **Define/Explain EIRP (Equivalent Isotropic Radiated Power) and show its relationship with Power Flux Density.**
   (S24 - Q5a, 03 marks)
   (W22 - Q4 OR(a), 03 marks)
   (W23 - Q4b, 04 marks)
   (W24 - Q3a, 03 marks)
2. **Define/Explain Flux Density.**
   (W25 - Q4 OR(a), 03 marks)
   (S24 - Q4 OR(a), 03 marks)
3. **Derive Friis transmission equation for received power.**
   (W22 - Q4 OR(b), 04 marks)
   (S22 - Q4b, 04 marks)
4. **Explain/Draft a satellite link budget.**
   (W25 - Q4 OR(c), 07 marks)
   (S24 - Q4 OR(c), 07 marks)
   (S23 - Q4a, 03 marks)
5. **Explain Carrier-to-Noise (C/N) ratio calculations in clean air and rainy conditions.**
   (W25 - Q5c, 07 marks)
   (S24 - Q4c, 07 marks)
   (S22 - Q5 OR(c), 07 marks)
6. **Define/Explain System Noise Temperature and its calculation.**
   (W25 - Q4 OR(b), 04 marks)
   (S24 - Q4 OR(b), 04 marks)
   (W24 - Q3c, 07 marks)

Other Important Questions (Newest to Oldest):

1. **Define C/N ratio and explain its importance in satellite link design.** (W25 - Q5a, 03 marks)
2. **Explain how rain attenuation affects the C/N ratio of a satellite link and how it is compensated.** (W25 - Q5b, 04 marks)
3. **Explain the received signal power equation used in satellite link budget calculations.** (S23 - Q4b, 04 marks)
4. **Discuss the impact of weather conditions on the satellite link budget and C/N ratio calculations.** (S23 - Q5c, 07 marks)
5. **Define following terms. (1) Noise factor (2) Noise Temperature (3) Carrier to Noise ratio.** (W22 - Q4a, 03 marks)
6. **Explain various uplink path losses in satellite communication.** (W22 - Q4b, 04 marks)
7. **Explain how to compute uplink and downlink C/N ratios for a typical satellite link.** (W22 - Q4c, 07 marks)
8. **Define Downlink. Draw a pictorial representation of a Downlink. Show the power budget calculations for a downlink path.** (W22 - Q4 OR(c), 07 marks) [Figure given - refer Question paper of W22]
9. **What is link power budget equation? Explain briefly.** (W23 - Q5b, 04 marks) (S22 - Q5b, 04 marks)
10. **Describe the Noise temperature of absorptive networks with necessary equations and derive the equation for Overall system noise temperature.** (W23 - Q5c, 07 marks)
11. **Describe Noise temperature of absorptive networks and show that the noise factor of a lossy network is equal to its power loss.** (W24 - Q3c, 07 marks)
12. **Draw the complete satellite circuit which includes combined uplink and downlink. Derive the equation for combined Noise-to-carrier ratio (N_0/C).** (W24 - Q4c, 07 marks) [Figure given - refer Question paper of W24]
13. **Calculate the free space loss for a satellite at 42000 km from an earth station, if the**

signal frequency is 6 GHz. (S22 - Q4 OR(a), 03 marks)

14. **Calculate the radius of a circular orbit for which the period is 1 day.** (S22 - Q4a, 03 marks)
15. **Define elevation angle and azimuth angle.** (S22 - Q4 OR(a), 03 marks)
16. **A geostationary satellite is located at 90°W. Calculate the azimuth angle for an earth-station antenna at latitude 35°N and longitude 100°W.** (S22 - Q4 OR(b), 04 marks)
17. **Discuss the various design issues related with uplink design and give the Expression C/N ratio for the same.** (S22 - Q4 OR(c), 07 marks)
18. **Explain Noise Power Calculation in Satellite Link Budget.** (S22 - Q5b, 04 marks)
19. **A satellite stationed at a distance 38000 km from the surface of earth radiates a power of 3 watts... calculate the flux density at the earth station and the power received by the antenna of an effective area 8 m².** (S22 - Q5b, 04 marks)
20. **Write a short note on attitude control system.** (S22 - Q4c, 07 marks)

Unit 6: Modulation and Multiple Access Schemes

Repeated Questions:

1. **Define Multiple Access and explain its necessity.**
   (W25 - Q5 OR(a), 03 marks)
   (S23 - Q5a, 03 marks)
   (S24 - Q5a, 07 marks)
2. **Compare TDMA, FDMA, and CDMA.**
   (W25 - Q5c, 07 marks)
   (S24 - Q5 OR(c), 07 marks)
   (S22 - Q4c, 07 marks)
3. **Explain Code Division Multiple Access (CDMA).**
   (S24 - Q5b, 04 marks)
   (W22 - Q5c, 07 marks)
   (W24 - Q5 OR(b), 04 marks)
4. **Explain/Describe the SPADE system.**
   (S24 - Q5c, 03 marks)
   (W22 - Q5 OR(c), 07 marks)
   (S22 - Q5c, 07 marks)
5. **Explain/Describe Time Division Multiple Access (TDMA).**
   (W25 - Q5c, 07 marks)
   (S23 - Q5b, 04 marks)
   (W24 - Q5b, 04 marks)
6. **Explain/Describe Preassigned FDMA.**
   (W24 - Q2 OR(c), 07 marks)
   (W23 - Q4c, 07 marks)
7. **Explain/Describe Demand Assigned FDMA.**
   (W23 - Q5a, 03 marks)
   (S22 - Q5a, 03 marks)

Other Important Questions (Newest to Oldest):

1. **Compare Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), and Phase Shift Keying (PSK) in terms of bandwidth and power efficiency.** (W25 - Q5 OR(b), 04 marks)
2. **A satellite transponder uses TDMA to serve multiple earth stations. Explain the timing, synchronization, and guard time concepts involved in the system design.** (W25 - Q5c, 07 marks)
3. **Discuss the advantages and disadvantages of each multiple access scheme, and suggest situations where each would be most appropriate in satellite communication.** (S23 - Q4c, 07 marks)
4. **List the types of Multiple Access Scheme used in the satellite communication and give its comparisons.** (S23 - Q5c, 07 marks)
5. **What is SCPC?** (S23 - Q5a, 03 marks)
6. **What is meant by space division multiple access?** (S23 - Q5b, 04 marks)
7. **Compare FDM/FM-FDMA and SCPC-FDMA.** (W22 - Q5 OR(a), 03 marks)
8. **Give the difference between Multiplexing techniques and Multiple access techniques.** (W22 - Q5 OR(b), 04 marks)
9. **List the advantage and disadvantage of FDMA, TDMA and CDMA.** (W22 - Q5b, 04 marks)
10. **What is CBTR (Carrier and bit time recovery)?** (W22 - Q5a, 03 marks)
11. **Explain Demand assigned TDMA.** (W23 - Q5 OR(a), 03 marks)
12. **With diagram explain the function a basic CDMA system.** (W23 - Q5b, 04 marks) [Figure given - refer Question paper of W23]
13. **Describe: Preassigned TDMA with figures.** (W23 - Q5 OR(c), 07 marks) [Figure given - refer Question paper of W23]

14. **Define Direct sequence Spread Spectrum.** (W24 - Q5a, 03 marks)
15. **Explain Preassigned TDMA with diagram.** (W24 - Q5b, 04 marks) [Figure given - refer Question paper of W24]
16. **Explain satellite switched TDMA with diagram.** (W24 - Q5c, 07 marks) [Figure given - refer Question paper of W24]
17. **Illustrate the basic TDMA concept in which the stations transmit bursts in sequence. Draw necessary figures.** (W24 - Q5 OR(c), 07 marks) [Figure given - refer Question paper of W24]
18. **Describe the merits of Demand assigned TDMA system.** (S22 - Q5a, 03 marks)
19. **Describe: Satellite switched TDMA with figures.** (S22 - Q5c, 07 marks) [Figure given - refer Question paper of S22]
20. **Explain Various modulation schemes used in satellite communication.** (S22 - Q5 OR(b), 04 marks)
21. **Explain the DSSS-CDMA for satellite communication with necessary diagrams.** (S22 - Q4 OR(c), 07 marks) [Figure given - refer Question paper of S22]

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