Code No: **R204104D** **R20** **Set No. 1**

IV B.Tech I Semester Regular Examinations, January – 2024

SATELLITE COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 Discuss potential future developments in orbital mechanics and launch technologies that may revolutionize satellite deployment and maintenance. [14]

(OR)

2 Explain the concept of satellite constellations and their significance in enhancing global coverage and system redundancy. [14]

UNIT - II

3 a) Discuss the methods and sensors used for determining the attitude (orientation) of a satellite in space. How is this information crucial for satellite operations? [7]

b) Explain the role of battery systems in providing power during periods of eclipse or reduced solar exposure. How are these systems designed for reliability? [7]

(OR)

4 a) Explain how external forces and perturbations affect a satellite's orbit and how the attitude and orbit control system compensates for these disturbances. [7]

b) Discuss the components and technologies involved in the communication subsystem of a satellite. How is data transmitted between the satellite and Earth stations? [7]

UNIT - III

5 a) Define system noise temperature in satellite communication systems. Explain its significance in determining the overall system noise performance. [7]

b) Explain the basic principles of transmission theory in satellite communications. Discuss concepts such as modulation, bandwidth and signal-to-noise ratio (SNR). [7]

(OR)

6 Describe the factors that affect signal propagation in satellite communication, including path loss, free-space loss and atmospheric effects. How do these factors impact signal quality? [14]

Code No: **R204104D** **R20** **Set No. 1**

UNIT – IV

7 a) Discuss the concept of spread spectrum transmission and reception in CDMA systems. How does it enhance security and robustness in satellite communication? [7]

b) Describe the components and features of receivers employed in Earth stations. How do they demodulate and process signals received from satellites? [7]

(OR)

8 a) Explain the fundamental principles of Code Division Multiple Access (CDMA) in satellite communication. How does CDMA allow multiple users to share the same frequency band? [7]

b) Explain the key components and characteristics of transmitters used in Earth stations. How is power amplification achieved, and what frequency bands are commonly used? [7]

UNIT - V

9 Discuss the operational challenges associated with NGSO constellation designs, including satellite handovers, tracking and ground station coordination. [14]

(OR)

10 Explain the concept of Non-Geostationary Satellite Orbit (NGSO) constellations and their advantages over traditional GEO systems. What are the different NGSO constellation designs? [14]

Code No: **R204104D** **R20** **Set No. 2**

IV B.Tech I Semester Regular Examinations, January – 2024

SATELLITE COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 Compare the advantages and disadvantages of placing satellites in geostationary orbits versus low Earth orbits with a focus on communication applications. [14]

(OR)

2 Describe how satellite orbits and orbital parameters can impact the performance of communication systems, including signal latency and coverage area. [14]

UNIT - II

3 a) Describe the concept of sun-synchronous orbits and their significance in Earth observation missions. How is the attitude control system optimized for such orbits? [7]

b) Explain the allocation of frequency bands for satellite communication. What factors influence the choice of frequency bands for specific satellite missions? [7]

(OR)

4 a) Discuss the key components of a telemetry, tracking and command system used for satellite communication and control. Explain their roles and functions. [7]

b) Describe the different types of satellite antenna systems used for communication and data reception. How are antenna characteristics optimized for specific missions? [7]

UNIT - III

5 Explain the key considerations and components involved in designing the downlink of a satellite communication system. How are factors like frequency allocation and antenna selection determined? [14]

(OR)

6 Discuss the concept of G/T ratio in satellite communication. How does it relate to the system's ability to receive weak signals and maintain a strong link? [14]

Code No: **R204104D** **R20** **Set No. 2**

UNIT - IV

7 a) Describe the principles of Demand Assigned Multiple Access (DAMA) in satellite communication systems. How does DAMA optimize bandwidth usage? [7]

b) Explain the importance of tracking systems in Earth stations. How do they ensure continuous alignment with satellites in orbit and what tracking technologies are commonly employed? [7]

(OR)

8 a) Explain the concept of Satellite Switched TDMA (SS-TDMA) and its advantages in dynamic allocation of satellite resources. Provide an example of SS-TDMA operation. [7]

b) Discuss the various types of antennas used in Earth stations, including parabolic, helical, and phased-array antennas. What are the advantages and disadvantages of each? [7]

UNIT - V

9 Analyze the challenges related to interference and coordination in LEO and GEO satellite systems, considering the need for spectrum management and satellite positioning. [14]

(OR)

10 Compare the resilience of LEO and GEO satellite systems to various environmental challenges, such as space debris, radiation and atmospheric effects. [14]

Code No: **R204104D** **R20** **Set No. 3**

IV B.Tech I Semester Regular Examinations, January – 2024

SATELLITE COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 Compare and contrast different types of launch vehicles used for sending satellites into orbit, considering factors like payload capacity and cost-effectiveness. [14]

(OR)

2 Explain the methods and techniques used for orbit determination of satellites, including ground-based tracking and data analysis. [14]

UNIT - II

3 a) Explain the process of data downlink and uplink in a satellite's TT&C system. How is data transmitted between the satellite and ground stations? [7]

b) Discuss the importance of equipment reliability in satellite systems. What measures are taken to ensure the long-term operation of satellite components in the harsh space environment? [7]

(OR)

4 a) Describe the methods used for generating power on board a satellite, including solar panels and nuclear power sources. Discuss their advantages and drawbacks. [7]

b) Explain the purpose and importance of space qualification testing for satellite components and systems. What are some common tests conducted to ensure space worthiness? [7]

UNIT - III

5 Outline the process of calculating the carrier-to-noise (C/N) ratio in a satellite communication link. How is C/N used to determine link quality? [14]

(OR)

6 Describe the design considerations for the uplink of a satellite communication system, including transmitter power, antenna gain and link budget calculations. [14]

Code No: **R204104D** **R20** **Set No. 3**

UNIT - IV

7 a) Provide an example of a TDMA-based satellite communication system design, specifying frame parameters, user allocations and the advantages of TDMA in this scenario. [7]

b) Explain the concept of Frequency Division Multiple Access (FDMA) in satellite communication. How does it allocate frequency bands for multiple users? Provide an example. [7]

(OR)

8 a) Discuss the key considerations in link design when implementing TDMA for satellite communication. Include factors like time slot allocation and bandwidth management. [7]

b) Discuss the methods and techniques used to test the primary power systems of Earth stations. How the reliability and stability of power supply ensured? [7]

UNIT - V

9 Discuss the factors that affect data throughput in LEO and GEO satellite systems, including modulation techniques, bandwidth and capacity planning. [14]

(OR)

10 Explain the concept of propagation delay in satellite communication and its impact on LEO and GEO systems. How do these systems address latency concerns? [14]

Code No: **R204104D** **R20** **Set No. 4**

IV B.Tech I Semester Regular Examinations, January – 2024

SATELLITE COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks
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UNIT - I

1 Discuss the various orbital perturbations that affect satellite orbits such as gravitational forces from celestial bodies and atmospheric drag. [14]

(OR)

2 Provide a detailed explanation of orbital mechanics, including Kepler's laws and how they relate to the motion of satellites in space. [14]

UNIT - II

3 a) Explain the different methods used for controlling the attitude of satellites in space. Discuss the advantages and limitations of each method. [7]

b) Discuss the environmental challenges that satellites face in space, including radiation, vacuum, and thermal extremes. How are satellite systems designed to withstand these challenges? [7]

(OR)

4 Describe the strategies and techniques employed to control and adjust the orbits of satellites. How do these strategies vary for different types of orbits? [14]

UNIT - III

5 Provide an example of designing a satellite communication system for a specific application, including satellite selection, frequency allocation, antenna design and link budget calculations. [14]

(OR)

6 Walk through the steps involved in designing a satellite link budget for a specified C/N ratio. Discuss how link budget parameters are selected and optimized. [14]

Code No: **R204104D** **R20** **Set No. 4**

UNIT - IV

7 a) Explain the frame structure used in Time Division Multiple Access (TDMA) satellite communication systems. What are the components of a typical TDMA frame? [7]

b) Describe the phenomenon of intermodulation in FDMA systems. How can it affect signal quality and what measures are taken to mitigate it? [7]

(OR)

8 a) Outline the process of calculating the Carrier-to-Noise (C/N) ratio in an FDMA satellite communication system. Discuss the factors that influence C/N. [7]

b) Compare CDMA & TDMA in detail? [7]

UNIT - V

9 a) Discuss the frequency considerations for LEO and GEO satellite systems, including frequency bands used and their allocation for different types of services. [7]

b) Explain the essential orbital parameters that define the positions and movements of LEO and GEO satellites. How do these parameters impact satellite performance? [7]

(OR)

10 a) Describe the coverage area of LEO and GEO satellite systems. How does the choice of orbit affect the coverage footprint and the number of required satellites? [7]

b) Compare and contrast the key characteristics of Low Earth Orbit (LEO) and Geostationary Orbit (GEO) with regard to altitude, orbital period and their suitability for different satellite applications. [7]