**Sub Code:** BECT074 **ROLL NO……..……..**

**ODD SEMESTER EXAMINATION, 2024 – 25**

## IV Year (VII Sem) B.Tech.: Electronics & Communication Engineering

## SATELLITE COMMUNICATION

**Duration: 3:00 hrs** **Max Marks: 100**

***Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.***

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| Q 1. | Answer any two parts of the following. (10x2= 20)<br>a) (i) Discuss the key components of a satellite system. How do these components work together to perform the satellite's intended function? (5 marks)<br>(ii) Explain the significance of inclination angle in determining the satellite's coverage area. (5 marks)<br>b) Explain the various types of satellite orbits. Discuss their applications, advantages, and limitations with examples. (10 marks)<br>c) A satellite orbits Earth in an elliptical path with a semi-major axis of 10,000 km and an eccentricity of 0.1. (10 marks)<br>(a) Calculate the periapsis and apoapsis distances.<br>(b) If the satellite sweeps an area of $10^6$ km² in 2 hours at periapsis, calculate the area swept in 6 hours at apoapsis.<br>(c) Derive the relationship between orbital period and the semi-major axis for a satellite orbiting Earth. |
| Q 2. | Answer any two parts of the following. (10x2= 20)<br>a) (i) Derive the orbital velocity of a geostationary satellite. (5 marks)<br>(ii) Explain the significance of the orbital period of a geostationary satellite being 24 hours. How does it relate to the Earth's rotation. (5 marks)<br>b) Define polarization in the context of satellite communication. Discuss the importance of polarization in transmitting and receiving satellite signals. (10 marks)<br>c) In a satellite system operating at 20 GHz, depolarization reduces the received signal strength by 4 dB.<br>(a) Calculate the percentage reduction in signal power due to depolarization.<br>(b) Discuss how this impacts the overall link performance. (10 marks) |
| Q 3. | Answer any two parts of the following. (10x2= 20)<br>a) (i) A satellite in geostationary orbit uses solar panels to generate power. Calculate the total power generated if the solar panel area is 50 m² and the efficiency of the solar cells is 20%. (5 marks)<br>(ii) Explain the importance of the transponder in a communication satellite. How does it contribute to signal processing? (5 marks)<br>b) Discuss the concept of uplink and downlink in satellite communication. Why are different frequencies used for these operations? (10 marks)<br>c) Discuss the importance of link budgeting in the Earth segment of a satellite communication system. What parameters are considered, and how does it affect system performance? (10 marks) |
| Q 4. | Answer any two parts of the following. (10x2= 20)<br>a) (i) A satellite has an antenna gain of 30 dB and the received signal at the Earth station is -100 dBm. Calculate the effective isotropic radiated power (EIRP) of the satellite in dBW. (5 marks)<br>(ii) Define the space link in satellite communication. What are the key components of the space link? (5 marks) |

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| | b) What is the frequency reuse technique in satellite communication? How does it contribute to the efficiency of the space link? Also, explain the role of the satellite antenna in the space link. (10 marks)<br>c) A satellite operator plans to launch a communication satellite that will use the Ka-band (20-30 GHz) for both uplink and downlink. Discuss the advantages and challenges of using the Ka-band for the space link, including issues related to atmospheric attenuation and bandwidth availability. (10 marks) |
| Q 5. | Answer any two parts of the following. (10x2= 20)<br>a) (i) A VSAT terminal receives a signal with a power level of -105 dBm, and the noise power is -120 dBm. Calculate the signal-to-noise ratio (SNR**)** in dB for the system. (5 marks)<br>(ii) Describe the different types of VSAT network architectures. Compare and contrast the star topology and mesh topology used in VSAT systems. (5 marks)<br>b) A DBS operator wants to increase the number of channels broadcast from a single satellite by using spot beams. Discuss the technical and operational considerations for implementing this solution, including beam design, frequency reuse, and interference management. (10 marks)<br>c) A remote village needs to be connected to the internet through a VSAT system. Discuss the design considerations, including antenna size, frequency selection, link budget, and bandwidth allocation for setting up the VSAT communication in this scenario. (10 marks) |

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