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Question Paper Code : 90585

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025

Fifth/Sixth/Seventh/Eighth Semester

Electronics and Communication Engineering

CEC 352 – SATELLITE COMMUNICATION

(Common to : Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Sidereal time and Sidereal day.

2. Calculate the apogee and perigee heights for the orbit with semi major axis is 7884.64 km and eccentricity of 0.0005710. Assume an earth radius of 6371 km.

3. Give the theory of orbit control.

4. State the working principle of satellite transponder.

5. A satellite has a downlink frequency of 14 GHz and operates with a transmitted power of 6 W and antenna gain of 47.2 dB. Find the Effective isotropic Radiated Power in dBW.

6. List the losses that affects the received power in a satellite link design.

7. Distinguish between pre-assigned and demand assigned traffic in relation to TDMA satellite access.

8. List the salient features of CDMA.

9. Compare LEO and GEO satellites relative to their positions.

10. Mention the frequency range of DBS/DTH Television.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) State and explain Kepler's three laws of planetary motion with application to satellite communication. (8)

(ii) A satellite is orbiting in the equatorial plane with a period from perigee to perigee of 12 h. Given that the eccentricity is 0.002, calculate the semi-major axis. (5)

Or

(b) (i) Define look angles. Explain them with reference to a geostationary satellite and the earth station. (8)

(ii) An earth station is located at latitude 12° S and longitude 52° W. Calculate the antenna-look angles for a satellite at 70° W. (5)

12. (a) Describe the tracking, telemetry and command facilities of a satellite communication system with diagram.

Or

(b) Discuss in detail spinning satellite stabilization and momentum wheel stabilization of Attitude control in a satellite space system.

13. (a) (i) Explain noise temperature and derive the expression for system noise temperature for a noise model of a receiver. (8)

(ii) For a 4-GHz receiver with the following gains and noise temperatures: (5)

$T_{in} = 25$ K $T_{RF} = 50$ K $T_{IF} = 1000$ K $T_M = 500$ K $G_{RF} = 23$ dB $G_{IF} = 30$ dB

Calculate the system noise temperature assuming that mixer has a gain $G_M = 0$ dB. Recalculate the system noise temperature when the mixer has a 10 dB loss.

Or

(b) (i) Explain the basic principles and equations of uplink and downlink design of a satellite. (8)

(ii) Discuss the effects of rain induced attenuation and interference of a satellite space segment. (5)

14. (a) Discuss in detail the Time Division Multiple Access system with basic blocks and frame formats.

Or

(b) Discuss in detail the error control coding schemes employed in a satellite communication.

15. (a) Explain in detail about the Network architecture and access control protocol used for VSAT networks.

Or

(b) Explain the method of position determination on earth using satellite in a GPS system. State how it can be improved through differential GPS.

PART C — (1 × 15 = 15 marks)

16. (a) Evaluate how analog-to-digital transmission systems in satellite links handle signal degradation due to factors like Doppler shift, solar interference, and ionospheric effects.

Or

(b) Explain how does the design of satellite constellations (such as GEO, MEO, and LEO satellites) influence the effectiveness of communication for different types of data (voice, data, video).

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