Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 40585

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Fifth/Sixth Semester

Electronics and Communication Engineering

CEC 352 — SATELLITE COMMUNICATION

(Common to : Computer and Communication Engineering/Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Kepler's 2nd laws of planetary motion.
2. Mention the significance of sun transit outage.
3. Why thermal control is necessary in a satellite?
4. What is the difference between a transmitter and a transponder?
5. Define Fade margin.
6. What are the factors that affect the link design of a satellite?
7. TDMA over FDMA.
8. What are the advantages of DAMA?
9. What is the primary function of the INTELSAT series in satellite communication?
10. List the benefits of LEO satellites.

PART B — (5 × 13 = 65 marks)

11. (a) Describe in detail about locating satellite in the orbit and locating satellite with respect to earth.

Or

(b) (i) A satellite is moving in an elliptical orbit with the major axis equal to 42000 km. If the perigee distance is 8000 km, find the apogee and the orbit eccentricity. (5)

(ii) Find the viewing angle of a geostationary satellite orbiting at 42000 km from an earth station making an elevation angle of 25 degrees. (5)

(iii) Write short notes on ELV. (3)

12. (a) (i) Discuss in short about any two types of propulsion subsystem with diagram. (8)

(ii) Given that an Intelsat-6 series satellite with an initial mass of 4330 kg uses a bipropellant liquid propulsion system having a specific impulse specification of 290 seconds, calculate the mass of the propellant necessary to be burnt to provide a velocity increment of 100 m/s to carry out a certain orbit inclination correction manoeuvre. (5)

Or

(b) Describe the functions of antenna subsystems and various antenna used for satellite communication.

13. (a) (i) Calculate the carrier-to-noise spectral density ratio (C/N_0) for a link budget at 12 GHz? The parameters are as follows: free space loss is 186 dB, antenna pointing loss is 2 dB, atmospheric absorption is 3 dB receiver G/T is 17.5 dB/K, receiver feeder losses are 2 dB, and the EIRP is 48 dBW. (8)

(ii) Thermal noise in an earth station receiver results in a $(C/N)_{downlink}$ ratio of 20.0 dB. A signal is received from a bent pipe transponder with a carrier to noise ratio $(C/N)_{uplink}$ = 20.0 dB. What is the value of overall $(C/N)_0$ at the earth station? If the transponder introduces intermodulation products with (C/I) ratio = 24 dB, what is the overall $(C/N)_0$ ratio at the receiving earth station? (5)

Or

(b) (i) Illustrate the steps in calculating Noise temperature in satellite communication with necessary equation. (10)

(ii) Suppose we have a 4-GHz receiver with the following gains and noise temperatures: (3)

$T_{in} = 25K$ $G_{RF} = 23\,dB$

$T_{RF} = 50K$ $G_{IF} = 30\,dB$

$T_{IF} = 1000K$

$T_m = 500K$

Calculate the system noise temperature assuming that the mixer has a gain $Gm = 0$ dB.

14. (a) Elucidate FDMA in detail and also discuss about the interference in FDMA.

Or

(b) (i) Describe the advantages of PAMA for satellite networking. (7)

(ii) Compare any two coding schemes used in satellite communication. (6)

15. (a) (i) Illustrate the working of VSAT satellite. (7)

(ii) Compare the features of LEO with MEO. (6)

Or

(b) (i) Describe the working of Direct to Home Broadcasting Satellite. (7)

(ii) Write short notes on differential GPS. (6)

PART C — (1 × 15 = 15 marks)

16. (a) A satellite is currently running in its elliptical transfer orbit with apogee and perigee being at distances of 35786 Km and 300 Km respectively above the earth surface. If the transfer orbit inclination to the equatorial plane is 0°, calculate the incremental velocity to be given to the satellite at the apogee point by the apogee kick motor to circularize the orbit. (Assume earth radius = 6378 Km)

Or

(b) (i) A geostationary satellite has a round-trip propagation delay variation of 40 ns/s due to station-keeping errors. If the time synchronization of DS-CDMA signals from different Earth stations is not to exceed 20 % of the chip duration, Determine the maximum allowable chip rate so that a station can make a correction once per satellite round - trip delay. Assume the satellite round-trip delay to be 280 ms. If, the maximum chip rate is to be 25 Mbps, what should be the maximum permissible Doppler effect variation due to station-keeping errors? (10)

(ii) In a DS-CDMA system, the information bit rate and chip rate are respectively 20 kbps and 20 Mbps. Determine the processing gain in dB and also determine the noise reduction (in dB) achievable in this system. (5)
