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K 6115

M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Second Semester

Communication Systems

CO 1653 — SATELLITE COMMUNICATION

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are prograde and retrograde orbits?
2. A satellite is orbiting in a geosynchronous orbit of radius 41500 km. Find the velocity and time of orbit. $g_0 = 398600.5 \text{ km}^3/\text{s}^2$.
3. Why backup batteries are necessary inspite of solar arrays?
4. Find the gain and beamwidth of an antenna of diameter 2 m operating at 14 GHz. Assume an aperture efficiency of 60%.
5. Define G/T ratio of an earth station.
6. Compute the effective input noise temperature of a receiver whose noise figure is 10 dB.
7. What do you mean by linearizer?
8. Differentiate : Interference and noise for a wireless communication system.
9. What is the need of handoff?
10. Why cells are preferred in land mobile services?

PART B — (5 × 16 = 80 marks)

11. (a) (i) What are the needs of satellite communication in the modern world? (8)
- (ii) A geostationary satellite is orbiting at 42,000 km. If the radius of orbit of earth is 6385 km and sun's declination is $7^{\circ}15'$, calculate the duration of eclipse. Also calculate the starting time of eclipse if the satellite longitude is 83°E . (8)

Or

- (b) (i) Define Kepler's laws of orbiting bodies and derive an equation to show that the third law is true for any orbiting satellite. (10)
- (ii) Distinguish between synchronous, subsynchronous and non-subsynchronous types of satellites. (6)
12. (a) (i) Explain how altitude and orbit control is achieved from an earth station. (8)
- (ii) The mass of earth being 5.9733×10^{24} kg and gravitational force 6.673×10^{-20} km³/kgs², calculate gravitational constant g_0 . If the exact radius of orbit is to be 42164,57 km calculate the velocity, angular velocity, orbit period and acceleration of the satellite. (8)

Or

- (b) (i) What are the different types of batteries used in satellites? Explain in detail. Describe the need of reflective layer and ultraviolet filter in solar batteries. (8)
- (ii) Explain the global beam and spot beam antennas. Give their applications. (8)
13. (a) (i) Discuss on ionospheric and tropospheric effects in space communication. (8)
- (ii) With a block diagram explain a typical PCM/TDM system. Discuss its merits and demerits. (8)

Or

- (b) (i) Explain in detail the losses that occur during propagation of EM wave from earth station to satellite and vice versa. In what way they help in satellite communication link design? (10)
- (ii) In a satellite link the propagation loss is 200 dB. Other losses are 3 dB. The receiver G/T is 11 dB/K and the EIRP is 45 dBW. Calculate the received C/N for an FDM baseband consisting of 96 voice channels. (6)

14. (a) Compare the major differences, advantages, disadvantages and applications of different multiple access techniques used in satellite communication. (16)

Or

- (b) (i) What is a burst? Explain the difference between the reference burst and the traffic burst. Explain their positions in a TDMA frame. Explain their structures. (8)
- (ii) A BPSK TDMA system is to transmit 1000 digital voice channels, each with 4 bits per sample at a 64 kbps rate. The system must accommodate 1000 data bits/slot at a frame efficiency of 90%
- (1) What is the number of slots in a frame? (2)
- (2) What is the length of TDMA frame? (2)
- (3) How many preamble bits can be used? (2)
- (4) What is the required satellite bandwidth? (2)
15. (a) Explain GSM architecture with appropriate diagrams. (16)

Or

- (b) (i) Discuss on INMARSAT systems. (8)
- (ii) Describe the features of video conferencing. (8)