

AMIETE – ET (OLD SCHEME)

Code: AE22
Time: 3 Hours

Subject: SATELLITE & SPACE COMMUNICATION
Max. Marks: 100

DECEMBER 2010

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after half an hour of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2x10)

a. The eccentricity (e) of an elliptical orbit with apogee (r_a) and perigee (r_p) respectively

(A) $e = r_a / r_p$

(B) $e = r_p / r_a$

(C) $e = (r_a + r_p) / (r_a - r_p)$

(D) $e = (r_a - r_p) / (r_p + r_a)$

b. The satellite orbit almost invariably used with remote sensing satellite is the

(A) Geostationary orbit

(B) Geosynchronous orbit

(C) Sun synchronous orbit

(D) Molniya orbit

c. In a spin stabilized geostationary satellite, the spin axis is

(A) Perpendicular to the orbital plane

(B) In the plane of the orbit

(C) Inclined at 45° to the orbital plane

(D) None of these

d. The multiple access system in which earth station has entire transponder Bandwidth available to it is.

(A) FDMA

(B) TDMA

(C) CDMA

(D) None of these

e. The commonly used analog modulation technique in satellite communication is:

(A) AM

(B) FM

(C) PAM

(D) PWM

f. In C band transponders, the down frequency is about

(A) 6 GHz

(B) 4 GHz

(C) 14 GHz

(D) 11 GHz

- g. Satellite capacity depends on
- (A) Weight that can be placed on orbit
 - (B) Panel area available for energy dissipation
 - (C) Transmitter power
 - (D) All of the above
- h. The minimum number of Geo stationary Satellite needed for uninterrupted global coverage is
- (A) 3
 - (B) 4
 - (C) 1
 - (D) 2
- i. Mostly VSAT operates in
- (A) C-band
 - (B) X-band
 - (C) ku-band
 - (D) S-band
- j. To provide the final output power requirement to transmit antenna the widely used amplifiers in transponder are
- (A) Parametric amplifier
 - (B) Klystron amplifier
 - (C) Magnetron amplifier
 - (D) Travelling wave tube

**Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.**

- Q.2** a. Why geostationary orbit is preferred for all high capacity communication satellite systems? Briefly explain Kepler's second law of planetary motion, with necessary illustrations. (8)
- b. For an eccentric satellite orbit with a apogee and perigee point at a distance of 50,000 km and 8000 km respectively from the centre of the earth. Determine semi –major axis, semi-minor axis and orbit eccentricity. (8)
- Q.3** a. Explain what is meant by rainrate and how this is related to specific attenuation. Explain effective path length in connection with rain attenuation. (8)
- b. Distinguish between atmospheric absorption and atmospheric attenuation. (4)
- c. A satellite transponder requires a saturation flux density of $110\text{dB}/\omega/\text{m}^2$ operating at frequency of 14 GHz. Calculate EIRP of earth station required if total losses is 200 dB. (4)
- Q.4** a. Explain what is meant by noise temperature and calculate system noise temperature and G/T ratio for earth station (6)

- b. For a satellite circuit the individual link carrier to noise spectral density ratios are uplink 100dB Hz, downlink 87dB Hz. Calculate the combined C/No ratio (4)
- c. Explain uplink and down link attenuation in rain and what are the effect of it in C/N. (6)
- Q. 5** a. What is frequency modulation? Write the equation at FM, Carson rule and S/N ratio for FM signal (5)
- b. What is time division multiplexing and explain TDM with Bell T1 PCM format (6)
- c. Explain the functional block diagram for bit timing recovery (5)
- Q. 6** a. Explain Spinning satellite stabilization and moment wheel Stabilization. (10)
- b. Explain satellite wide band receiver in detail. (6)
- Q. 7** a. Write a note on TDMA .Explain reference burst and preamble in detail (8)
- b. Write a note on CDMA and explain the principle of direct sequence spread spectrum (CDMA) (8)
- Q. 8** a. Explain BCH and Hamming codes? (4)
- b. Write a note on convolutional codes .Explain rate 1/2 convolution encoder and its tree diagram. (7)
- c. A satellite TV link is designed to provide a video S/N ratio of 62 dB. The peak deviation is 9 Mhz and the highest video baseband frequency of 4.2Mhz. Calculate the C/N ratio required at the input to the FM detector. Given that the combined noise weighting emphasis improvement and implementation margin is 11.8 dB. (5)
- Q.9** a. What are the various network architecture. Explain them in detail: (8)
- b. Explain VSAT and how it causes interference to other satellite devices (8)