

Code: D-17
Time: 3 Hours
100

Subject: ELEMENTS OF SATELLITE COMMUNICATION
June 2006

Max. Marks:

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.
- 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 best alternative in the following: (2x10)

- a. When the orbit eccentricity equals unity, the shape of the orbit would be
- (A) an ellipse (B) a circle
 (C) a parabola. (D) a hyperbola
- b. The height of the geostationary orbit from the earth's surface is
- (A) 900 kms (B) 1800 kms
 (C) 42,500 kms (D) 35860 kms
- c. The figure of merit for a satellite transmitter is the
- (A) G/T ratio. (B) C/N ratio.
 (C) EIRP. (D) I/C ratio.
- d. The factor which expresses in decibels, the improvement afforded by the FM system in return for a sacrifice of bandwidth, with usual notations, is
- (A) $20 \log (0.5) m^2$. (B) $10 \log (0.5) m^2$.
 (C) $20 \log (1.5) m^2$ (D) $10 \log (1.5) m^2$.
- e. In the present day standard digital voice communication, the amplitude of the voice signal is sampled at a rate of around
- (A) 800 samples /sec . (B) 2000 samples /sec .
 (C) 8000 samples /sec . (D) 16000 samples/sec .
- f. The bandwidth in M-ary FSK, for a symbol frequency of f_s is

necessary illustrations.

(10)

b. Why frequency modulation is used in satellite analog communication links? What is the relationship between the $(S/N)_o$ and (C/N) at FM detector in the satellite receiver, expressed in decibels? (4)

c. An FM satellite signal has a deviation of 3 KHz with a baseband frequency of 1 KHz. What is the bandwidth of the signal? (2)

Q.4 a. Briefly explain the following:

(i) Bit (ii) Byte (iii) Baud. (6)

b. Name the additional units that you come across in a digital communication system as compared to its analog counter-part. What is a digital baseband signal? What is its advantage? Name the typical digital baseband signals commonly used. (7)

c. Binary data is transmitted over a link with usable bandwidth of 2400 Hz using the FSK signalling scheme. The transmit frequencies are 2025 Hz and 2225 Hz and the data rate is 300 bits/sec. What is the frequency of the unmodulated carrier and its deviation from the basic value for the binary signals transmitted? (3)

Q.5 a. Briefly explain the principle of TDMA. (5)

b. Write a note on TDMA burst structure. (6)

c. Write a note on satellites for weather forecast. (5)

Q.6 a. Which are the orbital aspects of importance? (6)

b. A satellite in an elliptical orbit has an apogee of 30000 Km and a perigee of 1000 Km. Determine the semi major axis of the orbit. (2)

c. Briefly explain the effects of eclipse on the working of satellites. (8)

Q.7 a. What are the main functional units of a communication satellite? Mention their primary function. Mention the main subsystems of a geostationary satellite. For each sub system, what are the functions performed and the parameters of importance? (13)

b. A Ku-band 20-m paraboloidal antenna has been designed for a satellite earth station. Calculate the gain of the antenna for the Uplink. Assume an aperture efficiency of 0.648. Assume Ku-band frequency of 14-25 GHz for uplink. (3)

- Q.8** a. What is an earth station? With a neat schematic, explain the operation of an earth station transmitter. **(8)**
- b. Why are transmitters called the expensive part of an earth station? **(5)**
- c. Mention the salient features of a small earth station. **(3)**

Q.9 Write a brief note on any **TWO** of the following:

- (i) Direct Broadcast satellite (DBS).
- (ii) INSAT-II.
- (iii) ASK and PSK modulation.
- (iv) Principle used in TDM and its comparison with FDM. **(2x8)**