JUNE 2008

Code: DE17   **Subject: ELEMENTS OF SATELLITE COMMUNICATION**
3 Hours   **Max. Marks: 100**

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.   The power in a QPSK signal is

(A) $A/\sqrt{2}$ **(B)** $A^2/\sqrt{2}$

(C) $A^2/2$ **(D)** None of the above

b.   An earth station uses an antenna of diameter 5 meters. If the efficiency of the antenna is 55%, then the gain of the antenna for a carrier frequency of 14 GHz is

(A) 31.2 dB   **(B)** 25.6 dB
(C) 15.9 dB   **(D)** 54.7 dB

c.   The approximate frequency range in megahertz for channel four of Cable TV is

(A) 40 to 70   **(B)** 66 to 72
(C) 30.25 to 50.75   **(D)** 4.75 to 7.25

d.   INSAT-1D was launched in

(A) June 1970   **(B)** June 1965
(C) June 1990   **(D)** June 1992

e.   The typical value of the G/T ratio of DBS is

(A) 14 dB/K   **(B)** 4 dB/K
(C) 8 dB/K   **(D)** 25 dB/K

f.   The typical LNA noise temperature of INTELSAT standard 'A' earth station is

(A) 15 K   **(B)** 90 K
(C) 150 K   **(D)** 40 K

g.   Use of BJTs in the design of high power amplifiers can generate powers of the order of

(A) 100 Watts   **(B)** 150 Watts

(C) 50 Watts   **(D)** 250 Watts

h. The TDMA frame time for INTELSAT-V Satellite is about

(A) 2 ms   **(B)** 9 ms

(C) 10 ms   **(D)** 7 ms

i. The total phase difference for the two levels in a BPSK system is

(A) zero degree   **(B)** 90 degrees

(C) 180 degrees   **(D)** 270 degrees

j. The jamming margin for a spread spectrum system with 30-dB process gain, minimum output SNR of 10-dB and a 2-dB of system implementation noise would be about

(A) 8-dB   **(B)** 10-dB

(C) 4-dB   **(D)** 18-dB

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

Q.2   a.   Name the six frequency bands allocated for use with satellite communication. Which is the important calculation of interest in the design of satellite communications link and write its equation for an idealised situation? What is the equation valid for a practical situation?   **(10)**

     b.   Three amplifiers are connected in cascade. If the gain of the amplifiers are 10^6, 10^4, and 10^3 respectively, calculate the equivalent noise temperature of the cascaded arrangement. Take the equivalent noise temperature associated with each amplifier as 100 K, 60 K, and 20 K
(6)

Q.3   a.   What type of modulation is used in satellite analog communication links? Give reasons for the choice. Distinguish between frequency division multiplexing and time division multiplexing in simple terms. Comment on the need for multiplexing in a satellite link. When do you recommend TDM?   **(10)**

     b.   Write a brief note on SCPC system.   **(6)**

Q.4   a.   Which are the additional building blocks required in a digital communication system as compared to its analog counterpart and why are they required?
(9)

     b.   Distinguish between PSK and QPSK. Briefly explain the slots of the Bell T_1-channel TDM system frame.   **(7)**

Q.5   a.   What do you mean by multiple access? What do you mean by TDMA? Briefly comment on the need for providing guard time between the bursts in TDMA frame. **(9)**

     b.   What is frequency hopping modulation technique and where is it used? **(3)**

     c.   With a neat sketch for illustration, give the details of the outdoor unit of a DBS home receiver. **(4)**

Q.6   a.   What is the special significance of the orbit of satellite in use for communication purposes? Derive the expression for the geosynchronous altitude from the centre of the earth and estimate its value by taking the radius of the earth to be 6370 Km. **(12)**

     b.   The orbital velocity of a satellite in a circular orbit situated at 640 Km above the earth's surface is 7.54 Km/s, when the radius of the earth is 6370 Km. What is the orbit period expressed in hours and minutes? **(4)**

Q.7   a.   What is the role of antennas in a satellite link? What is the effect of aperture blocking in reflector antennas and how can this be removed **(7)**

     b.   What are the functions of Telemetry, tracking, and command subsystem? Comment in brief on the features of the command subsystem. **(6)**

     c.   Comment on the important capabilities of INSAT-1 satellite. **(3)**

Q.8   a.   What is order of power transmission requirement in an earth station and how is it achieved? Write the basic block diagram of an earth station receiver and briefly explain. **(11)**

     b.   Explain telephone services via Satellite. **(5)**

Q.9   Briefly explain the following: **(16)**
- (i)   Switched Star topology in Cable TV system
- (ii)   Satellite for Earth observation