(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2882 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VII) THEORY EXAMINATION 2011–12

SATELLITE COMMUNICATION

Time : 3 Hours *Total Marks : 100*

Note :– (i) Attempt **all** questions.

(ii) All questions carry equal marks.

(Given- Kepler's constant = 3.9861×10^5 km^3/s^2, Boltzmann's constant, k = 1.38×10^{-23} J/K)

1. Attempt any **four** parts of the following : **(5×4=20)**

(a) What is meant by look angles ? Explain them with reference to a geostationary satellite and the earth station.

(b) Satellite-1 in an elliptical orbit has the orbit semi major axis equal to 18000 km and satellite-2 in an elliptical orbit has semi-major axis equal to 24000 km. Determine the relationship between their orbital periods.

(c) With the aid of a neat sketch, explain what is meant by each of the angles :

inclination; argument of perigee; right ascension of the ascending node.

(d) Explain briefly what is meant by sun transit outage ?

 orbit from the earth ?

(f) What is meant by station keeping of satellite ? Explain its significance and also the methods to achieve it.

2. Attempt any **four** parts of the following : **(5×4=20)**

(a) With the help of a simple block diagram, explain the function of telemetry, tracking and command (TTC) sub-system.

(b) Give the name of space craft antennas and explain any two in detail with diagrams.

(c) A satellite carrying a 11.7 GHz continuous wave (CW) beacon transmitter is located in geosynchronous orbit 38000 km from an earth station. The beacon's output power is 200 mW, and it feeds an antenna with an 18.9 dB gain towards the earth station. The earth station receiving antenna aperture efficiency of 50 percent.

(A) Calculate the satellite EIRP in W, dBW and dBm,

(B) Calculate the path-loss in dB.

(C) Calculate the receiving antenna gain in dB.

(d) Derive the G/T ratio of earth station. What is the standard value for good quality of earth station ?

(e) How is the uplink design different than the downlink design ? In what conditions a complete satellite link become down link limited ?

(f) A 6/4 GHz band communication satellite transponder requires a saturation flux density of -67.5 dBW/m^2, when

an input back-off of 11dB is employed. The spacecraft has a G/T of -11.6 dB/K. If the downlink saturated EIRP is 26.6 dBW, estimate the back-off required if an overall (C/No) of 92.6 dBHz has to be maintained. The earth station G/T is 40.7 dB/K and total losses may be assumed to be 196.7 dB.

3. Attempt any **two** parts of the following : **(10×2=20)**

(a) What are the factors that affect the uplink design and the downlink design in geostationary satellite communication ? Discuss in detail.

(b) Write brief notes on the advantages and disadvantages of using satellite in LEO, MEO and GEO for mobile satellite communications.

(c) With the help of suitable diagram explain the satellite communication system architecture using VSAT. Also write the applications of VSAT.

4. Attempt any **two** parts of the following : **(10×2=20)**

(a) Explain the position location principle of GPS. Also draw the block diagram of a GPS receiver and explain its working.

(b) With the help of suitable diagram describe the working of home receiver units in direct broadcast satellite television.

(c) Write short notes on GPS navigation message and GPS timing accuracy.

5. Attempt any four parts of the following : (5×4=20)

(a) Describe the main features of the Iridium system, and comment briefly on how this differs from the Orbcomm system.

(b) Describe briefly about the types of low-gain directional mobile satellite antennas. Also name their applications.

(c) Briefly describe the types of antennas used for hand held terminals.

(d) Describe the features of phased-array antenna.

(e) Write short note on antenna systems for mobile satellite broadcasting.

(f) Write a short note on vehicle earth station antennas.