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CS/M.TECH (ECE)/SEM-2/MCE-205A/2013

2013

SATELLITE COMMUNICATION

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. **1** compulsorily and

any *four* from the rest.

1. Answer the following : 7 × 2

   a) What is meant by saying that a satellite is stationary ?

   b) Define 'Argument of Perigee'.

   c) What is the main advantage of TDMA over FDMA ?

   d) What is meant by 'Back Off' ?

   e) What is meant by 'Transponder Hopping' ?

   f) What is ALOHA ?

   g) The acronym SPADE stands for ..... .

2. a) Draw the block diagram of communication satellite and label each block. 3

   b) Draw and explain a single conversion transponder for 6/4 GHz band. Why is double frequency conversion scheme normally used in 14/11 GHz band ? 5

   c) A geostationary satellite provides service to a region which can be covered by the beam of an antenna with a beam width of 1·8°. The satellite carries transponder for *Ku* band with separate antennas to transmit and receive at centre frequency of 14/11 GHz. Find the diameter and gain of the receiving antenna. 6

3. a) Discuss about a TDMA frame structure. 4

   b) Discuss how synchronization can be achieved among different earth stations in a TDMA communication network. 4

   c) Deduce Basic Traffic Equation and using Erlang-B model write the expression for the probability that the last available channel is busy. 6

4. a) Discuss about the different factors which dominate the design of satellite communication system. 4

   b) Deduce Friss Transmission Equation. 5

   c) Consider a 4 GHz receiver with the following gains and noise temperatures :

   T_{in} = 60 K, T_{RF} = 40 K, T_M = 600 K, T_{IF} = 800 K and G_{RF} = 23 dB, G_M = – 10 dB, G_{IF} = 20 dB.

   Calculate the system noise temperature, where T_{in} , T_{RF} , T_M and T_{IF} are the noise temperature of input, *RF* stage, mixer and *IF* stage respectively and G_{RF}, G_M and G_{IF} are the gain corresponding to *RF*, Mixer and *IF* stae respectively. 5

5. a) Prove Kepler's first and third laws from the Second Order Differential equation of satellite orbit. 6

   b) A satellite is in an elliptical orbit with a perigee of 1000 km and an apogee of 4000 km. Using a mean earth radius of 6378·14 km find the period and eccentricity of the orbit. 4

   c) Give the names of different factors which cause orbital perturbations of the satellite. 4

6. a) Describe the principle of operation of an ADC/SCPC/PSK/FDMA Digital SCPC system. 5

   b) What are the advantages of voice activation ? 3

   c) Deduce the expression for carrier to Noise power of a composite system consisting of uplink, satellite and downlink in terms of (C/N) ratio of the uplink, down link and inter modulation product. 6

7. Draw the block diagram of a general earth station of a satellite communication system and describe the main blocks in brief.

8. Write short notes on any *two* of the following : 2 × 7

   a) active attitude control system

   b) Domestic satellite system using small earth station antenna.

   c) Various propagation factors which affect the transmission of satellite signal.