



Name :

Roll No. :

Invigilator's Signature :

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

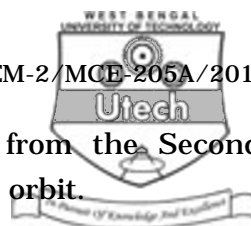
30512 (M.Tech)

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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 :
 $T_{in} = 60 \text{ K}$, $T_{RF} = 40 \text{ K}$, $T_M = 600 \text{ K}$, $T_{IF} = 800 \text{ K}$
 and $G_{RF} = 23 \text{ dB}$, $G_M = -10 \text{ dB}$, $G_{IF} = 20 \text{ dB}$.

 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.

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