	Utech
Name :	
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Invigilator's Signature :	

## CS/M.Tech (ECE)/SEM-2/MCE-204A/2010 2010

## SATELLITE COMMUNICATION SYSTEM

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 and any four from the rest.

1.	Cho	ose	the	correct	alternati	ves	for	any	ten	of	the
	follo	wing	g :						10	× 1 =	10
	i)	Earth station figure-of-merit is defined as									
		a)	101	og [G/T]		b)	10	ln [G/	T]		
		c)	101	og GT		d)	20	log [G	/T].		
	ii)	In abo		C band	transpond	lers	dow	nlink	frequ	iency	y is
		a)	6 G	Hz		b)	4 G	Hz			
		c)	11 (	GHz		d)	14	GHz.			
	iii)	Sat	ellite	capacity	depends of	n					
		a)	weig	ght that o	can be plac	ed i	n orb	it			
		b)	panel area for energy dissipation								
		c)	tran	smitter j	power						
		d)	all c	of these.							
	iv)	The	e satel	lite veloc	city is	• • • • • •	a	at the	perige	ee po	int.
		a)	min	imum		b)	max	ximun	1		
		c)	nil			d)	non	e of tl	nese.		

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v)	A satellite earth station antenna has a gain of $10^{\circ}$ and noise temperature of $100^{\circ}$ K. The earth station (G/T) idB/Kelvin is						
	a)	40 dB/K	b)	80 dB/K			
	c)	indeterminate	d)	none of these.			
vi) The earth station antenna is fed from a power producing 2 kW at its output. If the waveguithe amplifier output and the antenna input hat 2 dB and the antenna has a gain of 51 coperating uplink frequency, the EIRP of the an							
	a)	82 dB	b)	49 dB			
	c)	86 dB	d)	none of these.			
vii) Which one of the following satellites is in a eccentric, inclined orbit?							
	a)	Molniya series	b)	Raduga			
	c)	Ekran	d)	Gorizont.			
viii)	The range between a ground station and a satellite is 42000 km, the free space loss in dB at 6 GHz will be						
	a)	200·4 dB	b)	100 dB			
	c)	104·2 dB	d)	250 dB.			
ix)	n angle						
	a)	90 degrees	b)	> 90 degrees			
	c)	zero degrees	d)	< 90 degrees.			
x)	length is 15 ms and 3 ms; the efficiency is						
	a)	78%	b)	80%			
	c)	60%	d)	70%.			
xi)	Satellites are always launched towards						
	a)	east	b)	west			
	c)	north	d)	south.			
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xii) How many GEO satellites are needed to cover the whole earth?

a) 7

5 b)

c) 4 d) 3.

xiii) To make satellite visible from an earth station the maximum angular separation between the earth station & the sub-satellite point is limited by

a)

 $\gamma \le \cos^{-1} \left( r_e / r_s \right)$  b)  $\gamma > \cos^{-1} \left( r_e / r_s \right)$ 

c)

 $\gamma = \cos^{-1}(r_e/r_s)$  d)  $\gamma \ge \cos^{-1}(r_e/r_s)$ .

2. Derive general link equation. Find out the expressions a) for C/N and G/T ratio.

An earth station antenna has a diameter of 30 m. has b) an overall efficiency of 68%, & is used to receive a signal at 4150 MHz. At this frequency, the system noise temp. is 79 K, when the antenna points at the sat at an elevation angle of 28°. What is the earth station G/T ratio under these conditions? If heavy rain causes the sky temp. to increase so that the sys noise temp.rises to 88 K, what is the new G/T value? What are your observations? (4+2+2)+3+3+1

3. Draw and explain burst structure used for DA-TDMA. a)

A traffic intensity of 1 Erlang is offered to a group of b) 3 channels. The average call holding time is 2 min.

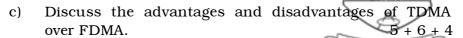
Calculate —

i) the average number of call arrivals/hr

ii) the probability that no call will arrive during a specified period of 2 min

iii) the probability that a call will be blocked.

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4. What are Kepler's laws of planetary motion? Explain them.

A satellite is in a 322 km high circular orbit. Determine —

- i) orbital velocity in metres per second,
- ii) the orbital period in minutes.

Given : average radius of the earth is 6378 km and Kepler's constant has the value,  $3.986 \times 10^5 \text{ km}^3/\text{s}^2$ .

9 + 6

- 5. a) Discuss different types of satellites LEO, MEO and GEO.
  - b) What is the difference between geostationary satellite and geosynchronous satellite? 12 + 3
- 6. a) What are look angles and subsatellite point?
  - b) Derive expression for elevation angle.
  - c) What do you mean by slant range? Explain with the help of diagram.

For a GEOsatellite it is given a minimum elevation angle =  $5^{\circ}$ , the maximum slant range d = 41127 km,  $c = 2.9979 \times 105$  km/s (speed of the light).

Find satellite round trip delay. (3 + 3 + 1) + 5 + 3

7. Name the equipment that an earth station requires.

Explain with suitable diagram the working of various antenna systems to be used in earth stations. 3 + 12

- 8. Write short notes on any *three* of the following :  $3 \times 5$ 
  - a) GPS
  - b) VSAT
  - c) SPADE
  - d) Satellite subsystems
  - e) Satellite launching techniques.