

Name : .....

Roll No. : .....

Invigilator's Signature : .....

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

**2010**

**SATELLITE COMMUNICATION SYSTEM**

Time Allotted : 3 Hours

Full Marks : 70

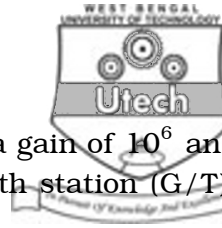
*The figures in the margin indicate full marks.*

*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. Choose the correct alternatives for any *ten* of the  
following :  $10 \times 1 = 10$

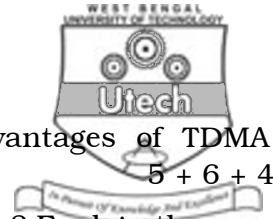
- i) Earth station figure-of-merit is defined as
  - a)  $10 \log [G/T]$
  - b)  $10 \ln [G/T]$
  - c)  $10 \log GT$
  - d)  $20 \log [G/T]$ .
- ii) In the C band transponders downlink frequency is about
  - a) 6 GHz
  - b) 4 GHz
  - c) 11 GHz
  - d) 14 GHz.
- iii) Satellite capacity depends on
  - a) weight that can be placed in orbit
  - b) panel area for energy dissipation
  - c) transmitter power
  - d) all of these.
- iv) The satellite velocity is ..... at the perigee point.
  - a) minimum
  - b) maximum
  - c) nil
  - d) none of these.



- v) A satellite earth station antenna has a gain of  $10^6$  and a noise temperature of  $100^\circ \text{ K}$ . The earth station (G/T) in dB/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 amplifier producing 2 kW at its output. If the waveguide joining the amplifier output and the antenna input has a loss of 2 dB and the antenna has a gain of 51 dB at the operating uplink frequency, the EIRP of the antenna is
- a) 82 dB                      b) 49 dB  
c) 86 dB                      d) none of these.
- vii) Which one of the following satellites is in a highly 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)  $200.4 \text{ dB}$                       b) 100 dB  
c)  $104.2 \text{ dB}$                       d) 250 dB.
- ix) Retrograde orbits have inclination angle
- a) 90 degrees                      b)  $> 90$  degrees  
c) zero degrees                      d)  $< 90$  degrees.
- x) In a TDMA frame total frame length is 15 ms and overhead portion of the frame is 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.

- Calculate —

- [ Turn over



- c) Discuss the advantages and disadvantages of TDMA over FDMA. 5 + 6 + 4
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  $d = 41127 \text{ km}$ ,  
 $c = 2.9979 \times 10^8 \text{ km/s}$  ( 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 × 5  
a) GPS  
b) VSAT  
c) SPADE  
d) Satellite subsystems  
e) Satellite launching techniques.
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