#  <br> Name : <br> Roll No. : <br> $\qquad$ <br> $\qquad$ <br> CS/M.Tech (ECE)/SEM-2/MCE-204A/2010 2010 SATELLITE COMMUNICATION SYSTEM 

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 :
i) Earth station figure-of-merit is defined as
a) $10 \log [G / T]$
b) $10 \ln [G / T]$
c) $10 \log \mathrm{GT}$
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 $\qquad$ 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 $100^{\circ} \mathrm{K}$. The earth station (G/T) in $\mathrm{dB} /$ Kelvin is
a) $40 \mathrm{~dB} / \mathrm{K}$
b) $80 \mathrm{~dB} / \mathrm{K}$
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) $200 \cdot 4 \mathrm{~dB}$
b) 100 dB
c) $104 \cdot 2 \mathrm{~dB}$
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.
xii) How many GEO satellites are needed to cover the whole earth ?
a) 7
b) 5
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) $\quad \gamma \leq \cos ^{-1}\left(r_{e} / r_{s}\right)$
b) $\quad \gamma>\cos ^{-1}\left(r_{e} / r_{s}\right)$
c) $\quad \gamma=\cos ^{-1}\left(r_{e} / r_{s}\right)$
d) $\quad \gamma \geq \cos ^{-1}\left(r_{e} / r_{s}\right)$.
2. a) Derive general link equation. Find out the expressions for $\mathrm{C} / \mathrm{N}$ and $\mathrm{G} / \mathrm{T}$ ratio.
b) An earth station antenna has a diameter of 30 m , has 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 $28^{\circ}$. 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 $\mathrm{G} / \mathrm{T}$ value ? What are your observations ? $\quad(4+2+2)+3+3+1$
3. a) Draw and explain burst structure used for DA-TDMA.
b) A traffic intensity of 1 Erlang is offered to a group of 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.

CS/M.Tech (ECE)/SEM-2/MCE-204A/2010
c) Discuss the advantages and disadvantages of TDMA over FDMA.
? Explain them.
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, $3.986 \times 10^{5} \mathrm{~km}^{3} / \mathrm{s}^{2}$.

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9+6
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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 $d=41127 \mathrm{~km}$, $c=2 \cdot 9979 \times 105 \mathrm{~km} / \mathrm{s}$ ( speed of the light).

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\text { Find satellite round trip delay. } \quad(3+3+1)+5+3
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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.

