

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2882

Roll No.

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B.Tech.

(SEM. VII) ODD SEMESTER THEORY

EXAMINATION 2013-14

SATELLITE COMMUNICATION

Time : 3 Hours

Total Marks : 100

Note :- (1) Attempt all questions.

(2) All questions carry equal marks.

(Given Kepler's constant = $3.986 \times 10^5 \text{ km}^3/\text{s}^2$, Earth's radius = 6360 km, Boltzmann's constant, $k = 1.38 \times 10^{-23} \text{ J/K}$)

1. Attempt any **four** parts of the following : **(5×4=20)**

- (a) Explain Kepler's laws of planetary rotation. How are these applied to the case of geostationary satellite ?
- (b) A satellite moving in a highly eccentric Molniya orbit having the farthest and the closest points as 35000 km and 500 km respectively from the surface of the earth. Determine the orbital time period and the velocity at the apogee and perigee points.
- (c) List the orbital elements of a satellite and briefly explain them.
- (d) What is the mechanism of launching a satellite ? Briefly explain each step of the launch sequence.

- (e) An earth station is located at 30° West longitude and 60° North latitude. Determine the earth station azimuth and elevation angles with respect to geostationary satellite located at 50° West longitudes. (Assume orbital radius = 42164 km and earth's radius 6360 km)
- (f) Explain what is meant by the geostationary orbit. How do the geostationary orbit and a geosynchronous orbit differ?
2. Attempt any **four** parts of the following : **(5×4=20)**
- (a) A satellite TV signal occupies the full 36 MHz transponder bandwidth and is desired to provide a carrier-to-noise (C/N) ratio of 22 dB at the earth station. If a downlink frequency of 4 GHz is employed and other losses amount to 3.4 dB, what must be the G/T of the earth station, if EIRP is 37 dBW ? The path length may be assumed to be 4000 km.
- (b) With the help of a simple block diagram, explain the function/working of a satellite transponder.
- (c) Explain how intermodulation noise originates in a satellite link, and describe how it may be reduced. In a satellite circuit the carrier-to-noise ratios are uplink-25 dB; intermodulation 13 dB. Calculate the overall carrier-to-noise ratio.
- (d) Describe the east-west and north-south station-keeping manoeuvres required in satellite station keeping. What are the angular tolerances in station keeping that must be achieved ?

- (e) The following parameters apply to a satellite downlink : saturation [EIRP] 22.5 dBW, free-space loss 195 dB, other losses are 1.5 dB, earth station G/T is 37.5 dB/K. Calculate the carrier-to-noise density (C/N_0) at the earth station. Assuming an output back-off of 6 dB is applied, what is the new value of (C/N_0) ratio ?
- (f) Explain what is meant by satellite attitude and briefly describe two forms of attitude control.
3. Attempt any **two** parts of the following : **(10×2=20)**
- (a) Describe about different types of atmospheric losses in satellite link.
- (b) Describe the operation of a typical VSAT system. State briefly where VSAT systems have widest application.
- (c) (i) What is Ice Effect ? Explain how depolarization is caused by rain.
- (ii) Write short note on Non-geostationary satellite system.
4. Attempt any **two** parts of the following : **(10×2=20)**
- (a) Explain the working of a Global Positioning System (GPS) receiver. Explain why a minimum of four satellites must be visible at an earth location utilizing the GPS system for position determination. What does the term dilution refer to ?
- (b) Explain the working of Direct Broadcast Satellite (DBS) television network.

- (c) (i) Briefly describe the video compression process used in MPEG-2 used in direct broadcast satellite television.
- (ii) Write short notes on the GPS codes and Signal Levels.
5. Attempt any **two** parts of the following : (10×2=20)
- (a) With the help of suitable diagram, explain the working of Iridium system.
- (b) (i) Describe briefly about the types of medium-gain directional mobile satellite antennas. Also name their applications.
- (ii) Describe the features of Wire Quadrifilar Helix Antenna. Why this antenna is used for handheld terminals?
- (c) Briefly describe the types of antennas used for mobile satellite broadcasting. What are their technical requirements?