

Registration No. :

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Total number of printed pages – 3

B. Tech
PEEC 5418

Eighth Semester Regular Examination – 2015
SATELLITE COMMUNICATION SYSTEMS

BRANCH(S) : AEIE, CSE, EC, EEE, EIE, ELECTRICAL, ETC, IEE, IT

QUESTION CODE : J 316

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.
The figures in the right-hand margin indicate marks.



1. Answer the following questions : 2 x 10
- (a) Write down the Kepler's three laws of planetary motion.
 - (b) What do the terms perigee and apogee mean when used to describe the orbit of a satellite orbiting the earth ?
 - (c) What are the ways to make a satellite stable in orbit ?
 - (d) A low earth orbit satellite is in a circular polar orbit with an altitude, h , of 1000km. The satellite transmits a frequency of 2.65 GHz. Find the velocity of the satellite in orbit and the Doppler shift of the received signal at the earth station.
 - (e) What is(are) the roles of transponder in satellite communication systems ? How many types of transponders are used in satellite ?
 - (f) How is TDMA different from FDMA ?
 - (g) What are the four types of antenna used in satellite ?
 - (h) Define noise figure. How is it related to noise temperature ?
 - (i) Define the beamwidth of an antenna. What is the dimension of a horn antenna operating at 4GHz and beamwidth of 17° ?
 - (j) Explain the two broad categories of rainfalls.

P.T.O.

2. (a) A C-band earth station has a transmit gain of 54 dB. The transmitter output power is set to 100 W at a frequency of 6.1 GHz. The signal is received by a satellite at a distance of 37,500 km by an antenna with a gain of 26 db. The signal is then routed to a transponder with a noise temperature of 500 K, a bandwidth of 36 MHz, and a gain of 110 dB. Calculate (i) the path loss, (ii) the power at the output port of the satellite antenna, in dBW, (iii) the noise power at the transponder input in a bandwidth of 36 MHz, (iv) the C/N ratio, in dB, in the transponder. 5
- (b) Describe the operation of a double conversion earth station receiver and represent the equivalent noise model of the receiver. What is the noise temperature of the system ? 5
3. (a) What is reliability of a satellite subsystem? Why do we need to calculate the reliability of a subsystem? Prove that reliability of a device decreases exponentially with time. 5
- (b) A satellite at a distance of 40000 km from a point on earth's surface radiates power of 10 W from an antenna with a gain of 17 dB in the direction of the observer. Find the flux density at the receiving point, and the power received by an antenna at this point with an effective area of 10 m². 5
4. (a) Write down the satellite communication link design procedures. 6
- (b) How does the rain affect the uplink and downlink satellite communication ? 4
5. (a) Explain briefly about propagation effects on satellite communication that are not associated with hydrometeors. 6
- (b) Explain the basic principle of a direct sequence spread spectrum (CDMA) system. 4
6. (a) How does the satellite communication system implement TDMA ? Derive the expression for the number of speech channels that can be carried by each earth station using a TDMA frame. 5
- (b) In a satellite system the stations operate in a TDMA mode. Speech signals are sampled at 8 kHz, using 8 bits/sample. The sampled PCM signals are then multiplexed into 40 Mbps streams at each station, using QPSK. Find (i) the bit rate for each PCM signal, (ii) the number of speech signals that could be sent by each earth station, as a single access, with no overhead, (iii) the shortest frame time for any TDMA schemes. 5

7. (a) A satellite in GEO orbit is at a distance of 39000 km from an earth station. The required flux density at the satellite to saturate one transponder at a frequency of 14.3 GHz is -90 dBW/m². The earth station has a transmitting antenna with gain of 52 dB at 14.3 GHz. Find (i) the EIRP of the earth station, (ii) the output power of the earth station transmitter. 5
- (b) Explain demand-assigned FDMA scheme with the help of SPADE. 5
8. Write short notes (any two): 5 × 2
- (a) Direct broadcast TV.
- (b) Mobile communication satellite.
- (c) Launch vehicle selection factor.
- (d) Cassegrain antenna.

