Registration no: | | | | | | | | | | |

Total Number of Pages:02 **B.Tech**
PEEC5418

8th Semester Regular / Back Examination 2015-16

SATELLITE COMMUNICATION SYSTEMS

Branch: AEIE, EIE, IEE
Time: 3 Hours
Max Marks: 70
Q.CODE: W133

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

Q1 Answer the following questions: **(2 x 10)**

a) If the amplifier has a quoted noise figure of 2.5 dB, then calculate the equivalent noise temperature at a reference temperature of 290 K.

b) What is the significance of EIRP in satellite communication?

c) What is beam steering?

d) Write down the different orbital elements used to describe unique orbital path in satellite communication.

e) Draw the block diagram of simplified double conversion transponder (bent pipe) for 14/11 GHz band with proper labeling.

f) How (G/T) ratio can be expressed in terms of (C/N) ratio?

g) What is the specific attenuation at 10 GHz, if the rainfall rate is 40 mm/h and linear vertical polarization is used?

h) Under what condition, the satellite is said to be geostationary satellite?

i) If the earth subtends an angle of 17^0 when viewed from geostationary orbit, then find out the dimension of the horn antenna used in the satellite communication that will provide global coverage at 4 GHz.

j) If G_I is the linear gain (less that unity and not in decibels) of the attenuating device or medium, then calculate the attenuation in dB?

Q2 **a)** Write down the design procedure for a one-way satellite communication link. **(5)**

b) For a Ku-band downlink design, **(5)**

Given that $(C/N)_o = 17$ dB when $(C/N)_{up} = 30$ dB.

Then calculate the value of $(C/N)_{dn}$.

Q3 **a)** Explain the uplink design in satellite communication. Find out the expression for the uplink attenuation? **(5)**

b) A satellite at a distance of 40000 km from a point on the earth's surface radiates a power of 10 W from an antenna with a gain of 17 dB in the direction of the observer. Find out the flux density at the receiving point and the power received by an antenna at this point with an effective area of 10 m^2. **(5)**

Q4 If a low earth orbit satellite is in a circular polar orbit with an altitude of 1000 km and a transmitter on the satellite has a frequency of 2.65 GHz, then find out the following parameters: **(10)**

(i) The velocity of the satellite in the orbit
(ii) The component of velocity towards an observer at an earth station as the satellite appears over the horizon for an observer who is in the plane of the satellite orbit.
(iii) Doppler shift of the received signal at the earth station. Use a mean earth radius value of 6378 km. The satellite also carries a Ka-band transmitter at 20 GHz.
(iv) Doppler shift for this signal when it is received by the same observer.

Q5 **a)** Derive the expression for the link equation and power received in any radio link. **(5)**

b) Explain the principle of operation spread spectrum transmission in the satellite communication. **(5)**

Q6 **a)** Discuss the propagation effects that are not associated with the hydrometeors. **(5)**

b) Explain the prediction of rain attenuation in satellite communication. **(5)**

Q7 **a)** What are the different stages required for the placement of satellite into a geostationary orbit. **(5)**

b) Suppose, the thermal noise in an earth station receiver results in a $(C/N)_{dn}$ ratio of 20 dB and a signal is received from a bent pipe transponder with a carrier to noise ratio $(C/N)_{up}$ of 20 dB. What is the value of overall $(C/N)_o$ at the earth station. If the transponder introduces intermodulation products with (C/I) ratio of 24 dB, then find out the overall $(C/N)_o$ ratio at the receiving earth station? **(5)**

Q8 Write short notes on any two: **(5 x 2)**

a) Random Access
b) Telemetry, tracking, command and monitoring (TTC&M) system
c) Satellite antenna and relationships
d) Link budgets