Total No. of Questions : 10]

SEAT No. :

P2027

[Total No. of Pages : 4

[5059] - 633

B.E. (E & TC) (Semester - II)

BROADBAND COMMUNICATION SYSTEMS

(2012 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Compare and contrast LED and ILD as light source for optical fiber communication. **[6]**

b) A multimode step index fiber with a core diameter of 80 μm and a relative index difference of 1.5% is operating at a wavelength of 0.85 μm. If the core refractive index is 1.48, estimate: **[4]**

i) the normalized frequency for the fiber

ii) the number of guided modes.

OR

Q2) a) Define the following terms with respect to single mode fiber **[6]**

i) Cut off Wavelength

ii) Mode field diameter

b) A multimode step index fiber has a relative refractive index difference of 1% and a core refractive index of 1 .5. The number of modes propagating at a wavelength of 1.3 μm is 1100. Estimate the diameter of the fiber core. **[4]**

P.T.O

Q3) a) The following parameters are established for a long-haul single-mode optical fiber system operating at a wavelength of 1.3 μm :

Mean power launched from the laser transmitter: – 3 dBm

Cabled fiber loss: 0.4 dB km^{-1}

Splice loss: 0.1 dB km^{-1}

Connector losses at the transmitter and receiver: 1 dB each

Mean power required at the APD receiver:

When operating at 35 Mbit s^{-1} (BER $l0^{-9}$): – 55 dBm

Required safety margin: 7 dB

Estimate the maximum possible link length without repeaters when operating at 35 Mbit s^{-1} (BER $l0^{-9}$). It may be assumed that there is no dispersion- equalization penalty at this bit rate. **[6]**

b) Write a short note on (ANY ONE) **[4]**

i) SOA

ii) EDFA

OR

Q4) a) Explain working principle of FBG and explain its usage as WDM de-multiplexor. **[6]**

b) What is need of WDM? Hence compare Dense WDM and Coarse WDM. **[4]**

Q5) a) State and explain Kepler's three laws of planetary motion. **[6]**

b) The apogee and perigee distance of a satellite orbiting in an elliptical orbit are, respectively, 45000 km and 7000 km. Determine the following **[6]**

i) Semi-major axis of the elliptical orbit

ii) Orbital eccentricity

iii) Distance between the center of Earth and the center of elliptical orbit.

c) A satellite is in an elliptical orbit with a perigee of 1000 km and an apogee of 4000 km. Using a mean earth radius of 6378 km, find the period of the orbit in hours, minutes and seconds, and the eccentricity of the orbit. **[6]**

OR

Q6) a) Compare and contrast use of LEO, MEO and GEO satellite earth orbits for the purpose of communication. **[6]**

b) The difference between the farthest and the closest points in a satellite's elliptical orbit from the surface of the Earth is 30000 km and the sum of the distances is 50000 km. If the mean radius of the earth is considered to be 6378 km, determine the orbit eccentricity. **[6]**

c) An earth station is located at 30° W longitude and 60° N latitude. Determine the earth station's azimuth and elevation angles with respect to a geostationary satellite located at 50° W longitude. The orbital radius is 42164 km. Assume radius of earth to be 6378 km. **[6]**

Q7) a) Explain with help of block diagram typical tracking, telemetry command and monitoring system. **[8]**

b) What are different types of antennas used in satellite systems? Explain importance of each. **[8]**

OR

Q8) a) Explain the following with respect to satellite **[8]**

i) Attitude Control System

ii) Orbit Control System

b) Explain double conversion transponder for 14/11 GHz band. Support your answer with suitable diagram and specify frequencies of local oscillators and IF amplifiers. **[8]**

Q9) a) A satellite at a distance of 40,000 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 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. **[8]**

b) Explain the following terms and hence explain their significance in satellite communication **[8]**

i) G/T Ratio for the Earth station

ii) Antenna Noise Temperature for the Earth station antenna

OR

Q10)a) Explain procedure for satellite Communication link design. **[8]**

b) A C-band earth station has an antenna with a transmit gain of 54 dB. The transmitter output power is set to 100 W at a frequency of 6.100 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. **[8]**

i) Calculate the path loss at 6.1 GHz

ii) Calculate the power at the output port (output waveguide flange) at the satellite antenna in dBW.

iii) Calculate the noise power at the transponder input, in dBW, in a bandwidth of 36 MHz.

iv) Calculate the C/N ratio in the transponder.