Satellite Communication VTU Question Paper Set

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10EC662

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Satellite Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the following: i) Geosynchronous orbit ii) Geostationary orbit **(04 Marks)**

b. Explain the following: i) Earth eclipse of satellite ii) Sun transit outage. **(06 Marks)**

c. With the help of relevant diagram and equations explain the Kepler's three laws of planetary motion. **(10 Marks)**

2 a. What are the different losses occurs during the radio propagation in a satellite link? **(10 Marks)**

b. Derive the system noise temperature (T_S) expression for amplifiers connected in series. **(06 Marks)**

c. An LNA is connected to a receiver which has noise figure 12 dB. The gain of the LNA is 40 dB and its noise temperature is 120 K. Calculate the overall noise temperature referred to the LNA input. **(04 Marks)**

3 a. Explain what is meant by antenna noise temperature and amplifier noise temperature. **(06 Marks)**

b. Derive an expression for the carrier to noise in satellite link. **(07 Marks)**

c. Explain what is meant by input and output backoff. **(07 Marks)**

4 a. What is meant by satellite altitude control and briefly describe two forms of altitude controls? **(07 Marks)**

b. Explain what is meant by thermal control and why this is necessary in a satellite. **(06 Marks)**

c. Explain what is meant by frequency reuse, and describe briefly two methods by which this can be achieved. **(07 Marks)**

PART – B

5 a. With neat diagram, explain the master antenna TV system. **(10 Marks)**

b. With suitable diagram, explain the possible interference modes between satellite circuits and terrestrial station. **(10 Marks)**

6 a. With appropriate diagram, explain the operation of the spade system of channel assignment. **(10 Marks)**

b. Describe the general operating principles of TDMA system and also explain the different components of reference burst in a TDMA system. **(10 Marks)**

7 a. Explain the following: i) Power rating of transponders.
ii) Frequency and polarization.
iii) Transponder capacity. **(10 Marks)**

b. With neat diagram, explain MPEG-2 encoder used in digital video transmission. **(10 Marks)**

8 a. Explain the following satellite mobile services :
i) Asian cellular system ii) Globalstar iii) Thuraya **(10 Marks)**

b. Explain the following: i) VSAT ii) GPS **(10 Marks)**

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10EC662

Sixth Semester B.E. Degree Examination, June/July 2016
Satellite Communications

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain briefly about various satellite communication services. **(06 Marks)**

b. State and explain the Kepler's law of planetary motion with neat diagram necessary equations. **(10 Marks)**

c. Explain frequency band allocations as per ITU. **(04 Marks)**

2 a. What are the orbit perturbations that take place because of non spherical nature of earth? **(10 Marks)**

b. Explain in detail the earth eclipse of satellite and sun transit outage. **(06 Marks)**

c. What is side real time? **(04 Marks)**

3 a. Explain what is meant by EIRP? A satellite down link at 12GHz operates with a transmit power of 6W and an antenna gain of 48.2 db calculate the EIRP in dbW. **(06 Marks)**

b. Calculate horizontal, vertical and circular polarizations for a frequency of 12GHz. The rain attenuation is exceeded for 0.01% of the time in any year, for a point rain rate of 10mm/hr. The earth station attitude is 600 meters and the antenna elevation angle is 50°. The rain height is 3km and $a_n = 0.0188$ $b_n = 1.217$ $a_v = 0.168$ $b_v = 1.2$. **(10 Marks)**

c. List four different transmission losses in a satellite link. **(04 Marks)**

4 a. What is a satellite transponder? With a neat block diagram explain the overall frequency arrangement of typical C band communication satellite. **(10 Marks)**

b. What are different types of satellite antennas? Explain briefly all of them. **(06 Marks)**

c. What are the major sub systems of a communication satellite? Explain its functions. **(04 Marks)**

PART – B

5 a. What is master antenna TV system? With the hap of a diagram describe an arrangement for MATV system. **(10 Marks)**

b. With a neat block diagram, Explain outdoor and the indoor unit for analog FM/TV. **(10 Marks)**

6 a. Describe briefly the modes of interference that can occur in satellite communication system. Distinguish between satellite and terrestrial mode of interference. **(10 Marks)**

b. The carrier to interference ratio at the ground receiving antenna is 23.3db. For the uplink [C/I] ratio is 27.53db. Find the overall ratio $[C/I]_{ant}$ for $[I/C]_U = 0.001766$ and $[I/C]_D = 0.004436$. **(06 Marks)**

c. Explain briefly different types of satellite access? **(04 Marks)**

7 a. Give the applications of Radarsat. Explain a "Dawn to Dusk" orbit. **(08 Marks)**

b. Explain frequency and polarization of direct broadcast satellite service. **(08 Marks)**

c. Explain bit rates of digital television. **(04 Marks)**

8 a. Calculate the bit rates that can be carried in the 24MHz channels using QPSK, allowing a roll off factor of 0.2. **(06 Marks)**

b. Describe the main features iridium system in detail with diagram and application. **(10 Marks)**

c. What are the applications of VSAT? **(04 Marks)**

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10EC662

Sixth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Satellite Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. List out any four advantages and four applications provided by satellites. **(08 Marks)**

b. List out the frequency band disignations in common use for satellite services. **(06 Marks)**

c. The apogee and perigee of an elliptical satellite orbits are 3000 km and 200 kms. Determine the eccentineity, semi-major axis and semi-minor axis. **(06 Marks)**

2 a. State Kepler's three laws of planetary motion, with suitable diagram and its relevant equations. **(08 Marks)**

b. With necessary diagram, define : i) Apogee ii) Prograde orbit iii) Inclination iv) Retrograde orbit. **(08 Marks)**

c. What is meant by sidereal time? Explain. **(04 Marks)**

3 a. Explain what is meant by rain rate and how this is related to specific attenuation. **(05 Marks)**

b. Derive the expression for $[C/N_0]$ for the uplink. **(10 Marks)**

c. An LNA is connected to a receiver to which has a noise figure of 12 dB, the cable loss is 5 dB, the LNA gain is 50 dB and its noise temperature is 150k. The antenna noise temperature is 35 K. Calculate the overall noise temperature referred to the input. **(05 Marks)**

4 a. What is meant by the term attitude control? Explain two forms of attitude control. **(12 Marks)**

b. With neat block diagram, describe the TT and C facilities of a satellite communication system. **(08 Marks)**

PART – B

5 a. With the suitable block diagram, explain the function of DBS – TV receiving system intended for home application. **(10 Marks)**

b. Explain and compare master antenna TV and community antenna TV. **(10 Marks)**

6 a. Describe briefly the modes of interference that can occur in a satellite communication system. Distinguish carefully between satellite and terrestrial modes of interference. **(10 Marks)**

b. Explain what the abbreviation "SPADE" system stands for. Explain in detail the operation of spade system. **(10 Marks)**

7 a. What is meant by TDMA? Explain the need for a reference burst in a TDMA system. **(10 Marks)**

b. What are different multiple access methods used in satellite communication? Briefly explain. **(06 Marks)**

c. Explain bit rate for digital television. **(04 Marks)**

8 Write short notes on :

a. Radar sat

b. Antenna look angle

c. GPS and its uses

d. VSat (VSAT). **(20 Marks)**

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10EC662

Sixth Semester B.E. Degree Examination, June/July 2015
Satellite Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain frequency allocations for a satellite. **(06 Marks)**

b. State and explain Kepler's three laws of planetary motion. **(06 Marks)**

c. With the help of neat diagram, explain Keplerian orbital elements. **(08 Marks)**

2 a. Explain how a satellite continues to be in orbit and derive expression for:
(i) Satellite velocity (ii) orbital period **(08 Marks)**

b. Define and explain Elevation and Azimuth angles of a ground station antenna for communication with an orbiting satellite. **(06 Marks)**

c. The orbit of an earth orbiting satellite has an eccentricity of 0.15 and semi major axis of 9000kms. Determine : (i) Periodic time (ii) Apogee height (iii) Perigee height. Given $h = 3.986 \times 10^5$ km^3/s^2. Assume a mean value of 6371 kms for earth's radius. **(06 Marks)**

3 a. Explain atmospheric and ionospheric losses for satellite communication. **(04 Marks)**

b. Calculate horizontal, vertical and circular polarizations for a frequency of 12GHz, the rain attenuation is exceeded for 0.01% of the time in any year, for a point rain rate of 10mm/hr. The earth station attitude is 600 meter, and the antenna elevation angle of 50°. The rain height is 3km and $a_h = 0.0188$: $b_h = 1.217$; $a_v = 0.168$; $b_v = 1.2$.
Note : All lengths and heights are in kms, and rain rate is in mm/hour. **(10 Marks)**

c. Explain the following : (i) Antenna Noise Temperature (ii) Amplifier Noise Temperature (iii) System Noise Temperature referred to input. **(06 Marks)**

4 a. With the help of neat diagram, explain two forms of attitude control. **(10 Marks)**

b. What is satellite transponder? With a neat diagram explain the overall frequency arrangement of typical C-band communication satellite. **(06 Marks)**

c. Write a short note on Thermal control. **(04 Marks)**

PART – B

5 a. Explain indoor and outdoor unit of direct Broadcasting satellite TV with block diagram. **(10 Marks)**

b. What is meant by pre-assigned FDMA? With a neat diagram, explain single channel per carrier. **(10 Marks)**

6 a. Explain the concept of TDMA and FDMA using appropriate figures. Discuss the relative advantages and disadvantages of each. **(10 Marks)**

b. The carrier to interference ratio at the ground receiving antenna is 23.3 dB. For the uplink (C/I) ratio is 27.53dB. Find the overall ratio $(C/I)_{ant}$ for $(I/C)_v = 0.001766$ and $(I/C)_D = 0.004436$. **(06 Marks)**

c. What are different interferences that occur in FDMA system? **(04 Marks)**

7 a. Explain (i) Transponder capacity (ii) Frequency and polarization. **(08 Marks)**

b. Describe the operation of typical VSAT system. **(06 Marks)**

c. Explain in detail the satellite mobile services. **(06 Marks)**

8 Write short notes on :

a. GPS and its uses

b. Radarsat

c. SPADE system

d. Earth Eclipse of satellites **(20 Marks)**

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10EC662

Sixth Semester B.E. Degree Examination, Dec.2014/Jan. 2015
Satellite Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Describe the various services provided by the satellite with the frequency band designations. **(06 Marks)**

b. Define the terms : i) Ascending node ii) Prograde orbit iii) mean anomaly iv) true anomaly. **(04 Marks)**

c. Determine the rate of regression of the nodes and the rate of rotation of the line of apsides for the satellite parameters, mean motion 14.23/day inclination 98.63, recentricty 00.00115, argument of perigee 113.55°, right ascension of the ascenting node 251.53° and constant $k_1 = 66063.1704$ km. Find the new values of argument of perigee and right ascension of the ascending node one period after epoch. Constant $\mu = 3.986005 \times 10^{14}$ m^3/s^2. **(10 Marks)**

2 a. What is sidereal time and mean solar time? Give the relation between them. **(05 Marks)**

b. What is sun synchronous orbit? How it is achieved. **(07 Marks)**

c. A geostationary satellite is located at 90°W. The average radius of the earth is 6371 km and radius of the circular orbit is 42164. The earth station antenna is at latitude 35°N and longitude 100°W. Determine the azimuth, elevation and range of the satellite. **(08 Marks)**

3 a. Derive the noise temperature for an absorptive network. Show that at room temperature the noise factor of a lossy network is equal to the power loss. **(06 Marks)**

b. A multiple carrier satellite circuit operates in the 6/4 GHz band with the following characteristics ; uplink - saturation flux density –67.5 dBW/m^2 ; input Bo 11 dB; free space loss 196.7 dB, earth station G/T is 40.7 dBk^{-1}. Constant $k = 1.38 \times 10^{-23}$ J/k. The other losses may be ignored. Calculate the combined uplink and down link C/N ratio. **(08 Marks)**

c. Find the rain attenuation for a frequency 12 GHz signal transmission from the earth station attitude 600 m and the antenna elevation is 50°. The rain height is 1.5 km and horizontal polarization is used. The rain rate $R_{0.01} = 15$ mm/h and attenuation coefficients $a_h = 0.0188$, $b_h = 1.217$. **(06 Marks)**

4 a. What are the functions of TT and C subsystem? Explain with a neat block diagram, of satellite control system. **(07 Marks)**

b. With a neat sketch, explain the operation of traveling wave tube amplifier. **(08 Marks)**

c. Describe briefly how the beam shaping of a satellite antenna radiation pattern is achieved. **(05 Marks)**

PART – B

5 a. Describe the master antenna TV system and the community antenna TV system. **(08 Marks)**

b. Explain the transit –receive earth station with a detected block diagram. **(07 Marks)**

c. A geostationary satellite employs a 3.5 m parabolic antenna at a frequency of 12 GHz. Find the –3 dB beam width and the spot diameter on the equator. **(05 Marks)**

6 a. Explain the operation of a spade system along with the channeling scheme. **(06 Marks)**

b. Describe the operating principle of a TDMA network. How the transmission bit rate is related to the input bit rate. **(07 Marks)**

c. A 14 GHz uplink operates with transmission losses 212 dB and a satellite [G/R] = 10 dB/k. The required uplink $[E_b/N_0]$ is 12 dB.

i) Assuming FDMA operation and on earth station uplink antenna gain of 46 dB, find the earth station transmitter power needed for T, baseband signal rate 1.544 Mb/s. Boltzmann's constant k = 1.38×10^{-23} J/k

ii) If the downlink transmission rate is 74 dBb/s find the uplink power increase required for TDMA **(07 Marks)**

7 a. Explain the satellite switched TDMA with the different modes of connectivity for three beams. How many switching modes are required for full inter connectivity? **(08 Marks)**

b. Explain the DBS frequency plan for region 2. **(06 Marks)**

c. How the bit rates for digital television are determined? Compute the uncompressed bit rate for SDTV format having resolution 640 × 480 pixels at 30 frames per second out 16 bit per pixel. **(06 Marks)**

8 a. Describe the operation of a typical VSAT system along with its application. **(08 Marks)**

b. Explain the GPS system for position determination. **(05 Marks)**

c. What is down to dusk orbit? Why the Ratarsat follows such an orbit? What are the application or Radarsat. **(07 Marks)**

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10EC662

Sixth Semester B.E. Degree Examination, June/July 2014

Satellite Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Illustrate basic structure of a satellite communication. List the applications. **(06 Marks)**

b. Explain briefly the various services provided by a satellite. **(06 Marks)**

c. With suitable diagram, compare Low Earth Orbit (LEO), Medium Earth Orbit (MEO), Geostationary orbit (GEO) satellite and its parameters. **(08 Marks)**

2 a. Explain what are the orbital perturbation that take place because of non-spherical earth. **(06 Marks)**

b. Explain in detail six orbital elements. **(06 Marks)**

c. Explain with neat diagram the Earth eclipse of satellite and sun transit outage. **(08 Marks)**

3 a. Explain what is effective path length. Show that the Rain Attenuation in dB is given by $A_p = aR_p^b L_s r_p$ with a neat diagram. **(08 Marks)**

b. Explain different transmission losses in a satellite link. **(06 Marks)**

c. A satellite link operating at 14 GHz has receiver feeder losses of 1.5 dB and a free space loss of 207 dB. The atmospheric absorption loss is 0.5 dB and the antenna pointing loss is 0.5 dB. Depolarization loss may be neglected. Calculate the total link loss for clear sky conditions? **(06 Marks)**

4 a. List out the major sub-systems required on satellite. **(06 Marks)**

b. Explain attitude and orbit control system. **(06 Marks)**

c. With a neat diagram explain telemetry, tracking command and monitoring system. **(08 Marks)**

PART – B

5 a. Explain with block diagram a Home Terminal for DBS TV/FM reception. **(10 Marks)**

b. Explain with block diagram a transmit-receive earth station. **(10 Marks)**

6 a. Describe briefly the modes of interference in a satellite communication system. Distinguish between satellite and terrestrial interference. **(10 Marks)**

b. Explain spade communication system with a neat diagram. Also, the channeling scheme for spade system. **(10 Marks)**

7 a. Explain: i) Orbit spacing, ii) Power rating, iii) Bit rate for digital television. **(10 Marks)**

b. Explain in detail very small aperture terminal (VSAT) and its applications. **(10 Marks)**

8 Write short notes on:

a. Orbit communication

b. Pre-assigned FDMA

c. Iridium **(20 Marks)**

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10EC662

Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Satellite Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Describe briefly the main advantages offered by satellite communications. Explain what is meant by a distance insensitive communication system. **(06 Marks)**

b. Explain the various frequency bands used and various services provided by a satellite. **(08 Marks)**

c. Describe briefly the development of INTELSAT starting from the 1960s through the present. **(06 Marks)**

2 a. Explain briefly the orbital parameters required to determine a satellite orbit. **(08 Marks)**

b. The two satellites are moving in different elliptical orbits with the same perigee but different apogee distances. The semimajor axes of the two orbits are 16000 km and 24000 km. Determine the orbital period of satellite 2 if the orbital period of satellite 1 is 600 min. **(04 Marks)**

c. An earth station is located at latitude 30°S and longitude 130°E. calculate the antenna-look angles for satellite at 156°E. Assume radius of earth 6371 km and a_{GSo} = 42,164 km. **(08 Marks)**

3 a. Explain what are rain rate, specific attenuation and effective path length in connection to rain attenuation? **(06 Marks)**

b. For an uplink the required [C/N] ratio is 20 dB. The operating frequency is 30 GHz, and the bandwidth is 72 MHz. The satellite [G/T] is 14.5 dBK^{-1}. Assuming operation with 11 dB input BO (i) Calculate the saturation flux density [RFL] arel dB (ii) The total losses amount to 218 dB. Calculate the earth station [EIRP] required. **(08 Marks)**

c. What is the system noise temperature? Derive the expression for equivalent noise temperature. **(06 Marks)**

4 a. Explain briefly the Telemetry, Telecommand and Tracking control (TTC-m) monitoring system of a communication satellite, with a block diagram. **(08 Marks)**

b. What is attitude control as applicable to satellites? Explain with the help of a diagram, spin stabilization of satellites. **(08 Marks)**

c. Explain: (i) Satellite transponder (ii) Frequency reuse. **(04 Marks)**

PART – B

5 a. With the aid of a block schematic, describe the functioning of a transmit-receive earth station used for telephone traffic. **(06 Marks)**

b. Explain what is meant by the term redundant earth station. **(04 Marks)**

c. (i) The desired carrier [EIRP] from a satellite is 34 dBW, and the ground station receiving antenna gain is 44 dB in the desired direction and 24.47 dB toward the interfering satellite. The interfering satellite also radiates an [EIRP] of 34 dBW. The polarization discrimination is 4 dB. Determine the carrier-to-interference ratio at the ground receiving antenna.

(ii) Station A transmits at 24 dBW with an antenna gain of 54 dB, and station C transmits at 30 dBW. The off-axis gain in the S_1 direction is 24.47 dB, and the polarization discrimination is 4 dB. Calculate the [C/I] ratio on the uplink.

(iii) Find the overall ratio $[C/I]_{ant}$, using the uplink and downlink values of [C/I] calculated. **(10 Marks)**

6 a. Explain the spade system, with a neat diagram. **(07 Marks)**

b. With a neat diagram, explain frame and burst formats for a TDMA system. **(07 Marks)**

c. A 14 GHz uplink operates with transmission losses and margins totaling 212 dB and a satellite [G/T] = 10 dB/K. The required uplink $[E_b/N_o]$ is 12 dB. (i) Assuming FDMA operation and an earth-station uplink antenna gain of 46 dB, calculate the earth-station transmitter power needed for transmission of a T_1 baseband signal. (ii) If the downlink transmission rate is fixed at 74 dBb/s, calculate the uplink power increase required for TDMA operation. **(06 Marks)**

7 a. Describe the operation of a typical VSAT system. State briefly where VSAT system found widest application. **(10 Marks)**

b. With respect to direct broadcast satellite services, explain (i) Orbital spacing (ii) Power rating and number of transponders (iii) Frequency of operation. **(10 Marks)**

8 a. Explain the global positioning system, in detail. **(10 Marks)**

b. Describe the main features of the Irridium system and comment briefly on how is this different from the orbcomm system. **(10 Marks)**

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10EC662

Sixth Semester B.E. Degree Examination, June/July 2013
Satellite Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What is satellite communication? List some of the services provided by satellite communication. **(06 Marks)**

b. Explain frequency allocations for a satellite services. **(04 Marks)**

c. State and explain the Kepler's law of planetary motion with neat diagrams and necessary equations. **(10 Marks)**

2 a. Define and explain the following terms applied to satellites in orbit:
i) Apogee and perigee points.
ii) Ascending and descending nodes.
iii) Prograde and retrograde orbits. **(10 Marks)**

b. An earth orbsting satellite, has an eccentricity of 0.15 and semimajor axis of 9000 kms. Determine: i) Apogee height; ii) Perigee height; iii) Its periodic time. Given $\mu = 3.986 \times 10^5$ km^3/S^2 and assume a mean value of 6371 kms for earth's radius. **(06 Marks)**

c. What are look angles? How they are determined? **(04 Marks)**

3 a. Explain atmospheric and ionospheric losses in satellite communication. **(06 Marks)**

b. A receiver operating at 2800 MHz is shown in block diagram form in Fig.Q.3(b). Calculate its (G/T) ratio in dB/K referred to the output port of the antenna. **(08 Marks)**

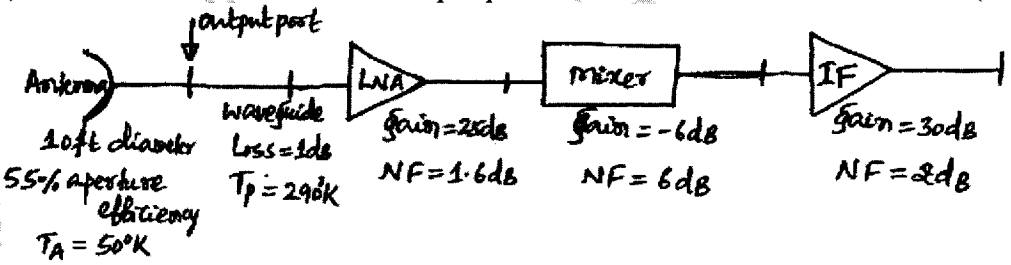

Fig.Q.3(b)

c. Calculate rain attenuation for a frequency of 12GHz for circular polarization. The rain rate of 10mm/h is exceeded for 0.01 percent of the year. The earth station attitude is 600 meters, and an antenna elevation angle is 50°. The rain height is 3 kms. [ah = 0.0188, $b_h = 1.217$, $a_v = 0.168$, $b_v = 1.2$]. **(06 Marks)**

4 a. Explain the functions of the following satellite subsystems:
i) Transponder.
ii) Power system.
iii) Wide band receiver.
iv) Telemetry, tracking and command system. **(08 Marks)**

b. What is meant by satellite altitude? With the help of neat diagram, explain two types of altitude control. **(12 Marks)**

PART – B

5 a. With the help of block diagram, explain the working of master antenna TV system. Compare CATV and MATV system. **(10 Marks)**

b. With the aid of a block diagram, explain the indoor and outdoor units of a receive only home TV system. **(10 Marks)**

6 a. Explain the concepts of TDMA and FDMA using appropriate figures. Discuss the relative advantages and disadvantages of each. **(10 Marks)**

b. The carrier-to-interference ratio at the ground receiving antenna is 23.3 dB. For the uplink [C/I] ratio is 27.53 dB. Find the overall ratio $[C/I]_{ant}$ for $(I/C)_U = 0.001766$ and $(I/C)_D = 0.004436$. **(06 Marks)**

c. What are the different interferences that occur in FDMA system? **(04 Marks)**

7 a. Explain in brief different types of satellite mobile services. **(10 Marks)**

b. Explain the following:

i) Transponder capacity.

ii) Frequency and polarization.

iii) Bit-rate and digital TV. **(10 Marks)**

8 Write notes on:

a. GPS and its uses.

b. Iridium.

c. Antenna look angles.

d. VSAT and its applications. **(20 Marks)**

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