	Reg. No.:	
	Name :	

VIT CHENNAI
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test – II – October 2024

Programme	:	**B.Tech (ECE)**	Semester	:	**Fall 2024-25**
Course	:	**Satellite Communication**	Code	:	**BECE310L**
			Slot	:	**B2+TB2**
Faculty	:	**Dr. Niraj Kumar** **Prof. J. Divya**	Class Nbr(s)	:	**CH2024250100148** **CH2024250100149**
Time	:	**90 Minutes**	Max. Marks	:	**50**

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer ALL the questions

Q.No.	Sub. Sec.	Question Description	Marks	BT Level
1.		Three identical large earth stations with 500 W saturated output power transmitters access a 36 MHz bandwidth transponder of a GEO satellite using FDMA. The earth stations are all at the same distance from the satellite. The transponder's saturated output power is 150 W and it is operated with 3 dB output backoff when FDMA is used. The gain of the transponder is 95 dB in its linear range. The bandwidths of the earth station signals are Station A: 25 MHz Station B: 20 MHz Station C: 10 MHz Find the power level at the output of the transponder, and at the input to the transponder, in dBW, for each earth station signal, assuming that the transponder is operating in its linear region with 3 dB output backoff. Each earth station must transmit 250 W to achieve an output power of 25 W from the transponder. Find the transmit power for each earth station when the transponder is operated with FDMA to make the PSD of each signal equal.	**[7]**	**L3**

2.		A TDMA network of seven earth stations shares a single transponder equally. The frame duration is 3.0 ms, the overhead time per station is 25 μs, and guard bands of 5 μs are used between bursts. Transmission bursts are QPSK at 40 Mbps. (i) Calculate the number of 256 kbps channels that each TDMA earth station can transmit. What is the efficiency of the TDMA system? [5 Marks] (ii) If the frame length is increased to 30ms, what is the new TDMA system efficiency? [3 Marks]	**[8]**	**L3**
3.		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 6.1 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. (a) Calculate the path loss at 6.1 GHz. [4 Marks] (b) Calculate the power at the output port (sometimes called the output waveguide flange) of the satellite antenna, in dBW. [4 Marks] (c) Calculate the noise power at the transponder input, in dBW, in a bandwidth of 36 MHz. [4 Marks] (d) Calculate the C/N ratio, in dB, in the transponder.[4 Marks] (e) Calculate the carrier power, in dBW and in watts, at the transponder output. [4 Marks]	**[20]**	**L5**
4.		The satellite in Question #3 above serves the 28 states and 8 UTs of India. The antenna on the satellite transmits at a frequency of 3875 MHz to an earth station at a distance of 39,000 km. The antenna has a 6° E-W beamwidth and a 3° N-S beamwidth. The receiving earth station has an antenna with a gain of 53 dB and a system noise temperature of 100 K and is located at the edge of the coverage zone of the satellite antenna. (Assume antenna gain is 3 dB lower than in the center of the beam) (a) Calculate the gain of the satellite antenna in the direction of the receiving earth station. [3 Marks] (b) Calculate the carrier power received by the earth station, in dBW. [4 Marks] (c) Calculate the noise power of the earth station in 36 MHz bandwidth. [4 Marks] (d) find the downlink and overall C/N in dB. [4 Marks]	**[15]**	**L4**
		Total Marks	**[50]**	

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