

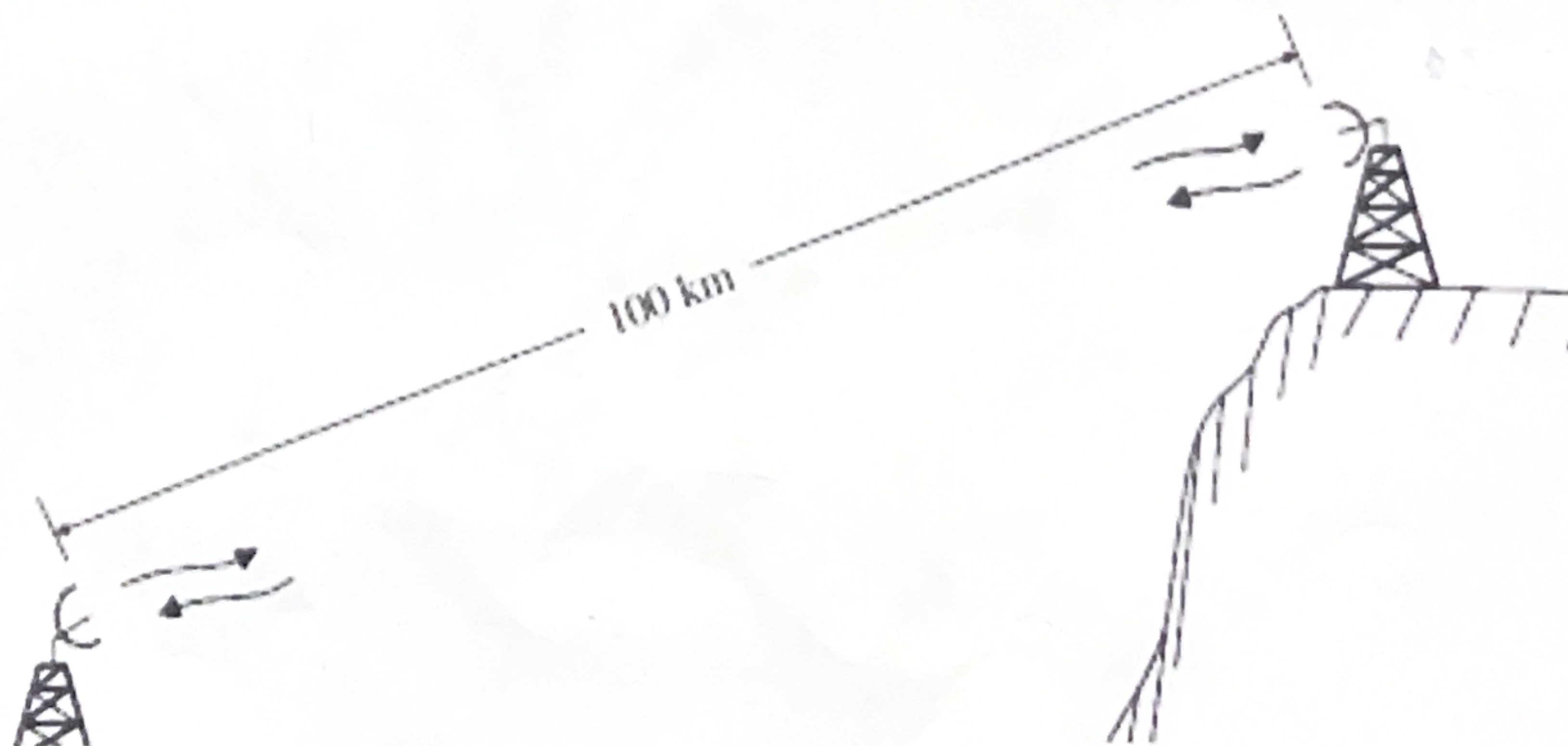
Problem 1 (10 points).

- (a) A signal is sampled, quantized and coded generating a PCM bit stream. If it is desired to reduce quantization noise by 75%, determine the improvement in SNR, and the new data bit rate. (4 points)
- (b) Assume voice signals are bandlimited to 3 kHz are sampled and quantized following the same format of T1 system. Determine the bit rate for 24 voice signals, signaling bit rate, synchronization speed, and the bits needed to be stuffed to TDMed this bit stream into level 2 of TDM in North American PDH. (6 points)

Problem 2 (10 points).

A microwave link is set up to communicate from a city to a nearby mountain top, as shown in Figure below. The distance is 100 km, and the operating frequency is 10 GHz. The receiver has a noise figure of 6 dB, a bandwidth of 30 MHz, and an operating temperature of 290 K. Calculate (a) the received power in watts and (b) the received carrier-to-noise power ratio in dB at the receiver output port. (c) Repeat (b) if there is a thunderstorm that gives an additional loss of 5 dB/km for a region of 5 km long between the transmitter and receiver.

Tx power	1000 W
Tx Feed loss	-1.5 dB
Tx antenna gain	45 dB
Tx Ant. pointing error	-1 dB
Atmospheric loss	-2 dB
Polarization loss	- 0.5 dB
Rx feed loss	-1.5 dB
Rx antenna gain	45 dB
Rx ant. pointing error	-2 dB



Problem 3 (10 points).

- (a) Determine the azimuth and elevation angles of an earth station located at 51° N, 0.5° E for communicating with geostationary satellite positioned at 10° W. (4 points)
- (b) At 10 GHz, a ground station transmits 128 W to a satellite at a distance of 2000 km. The ground antenna gain is 36 dB with a pointing error loss of 0.5 dB. The satellite antenna gain is 38 dB with a pointing error loss of 0.5 dB. The atmospheric loss in space is assumed to be 2 dB and the polarization loss is 1 dB. Calculate the received input power level and output SNR. The satellite receiver has a noise figure of 6 dB at room temperature. A bandwidth of 5 MHz is required for a channel, and a margin (loss) of 5 dB is used in the calculation. (6 points)

Good Luck