ABS Seminar no.4

T.1

Find AWGN channel capacity for infinite bandwidth. Hint: use the identity: $\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^{x}=e$ in terms of: $\frac{S}{N_0}$

T.2

Calculate the channel capacity if the received ratio: $E_b/N_0 = 7{,}5\ dB$ and system bandwidth is: $W = 10\ MHz$, we assume that: $W = R_b$

T.3

Calculate the channel capacity if the received ratio: $E_s/N_0 = 11\ dB$ and system bandwidth is: $W = 5\ MHz$, and the system uses 64QAM modulation.

T.4

Consider AWGN channel with bandwidth $W = 40\ MHz$ the total power of the received signal is: $S = 5mW$ and $N_0 = 2\times10^{-9}\ W/Hz$.
Calculate:

a) How to increase channel capacity if the received power doubles?
b) How much the channel capacity is reduced if the bandwidth is doubled?
c) Determine in which region the system works.

T.5

Consider a frequency non-selective channel with a bandwidth $W = 15\ MHz$ and a constant transmission power that provides the average value of the received SNR = 0 dB. Fast fading occur in the channel, while the instantaneous gain of the channel acquires discrete values with probabilities:

1. $G_{CH1} = 20\ dB$ with probability: $P_{CH1} = 0{,}1$
2. $G_{CH2} = 15\ dB$ with probability: $P_{CH2} = 0{,}25$
3. $G_{CH3} = 10\ dB$ with probability: $P_{CH3} = 0{,}15$
4. $G_{CH4} = 5\ dB$ with probability: $P_{CH4} = 0{,}25$
5. $G_{CH5} = 0\ dB$ with probability: $P_{CH5} = 0{,}15$
6. $G_{CH6} = -5\ dB$ with probability: $P_{CH6} = 0{,}1$

G_{CHi}; $i = 1, \cdots, 6$ is the channel gain for the given time instance, P_{CHi}; $i = 1, \cdots, 6$ is the probability of such event.

Find the average value of the channel capacity. Use the formulas:

$$C_{AWGN} = W \log_2 (1 + G_{CH} SNR) \qquad C_{ave} = \sum_i C_{AWGN\,i} P_{CH\,i}$$

G_{CH}	C_{AWGN} [Mb/s]	P_{CH}	$C_{AWGN} . P_{CH}$