Fundamentals of Communications
Examination from the Winter Semester (partially translated)

Subject 1:

A sinusoidal signal is transmitted as shown in Fig. 1. The intermediate amplifier is for the time being considered linear.

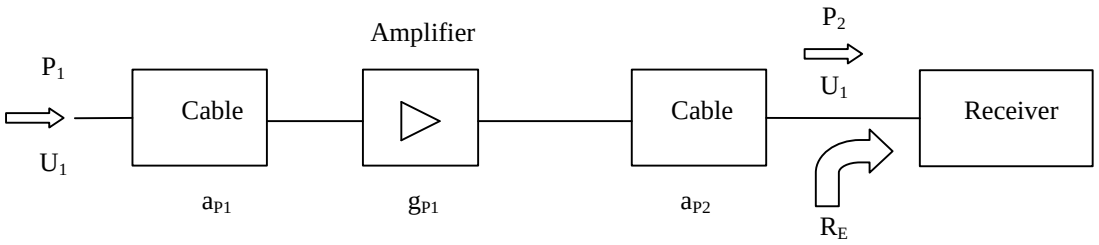

Figure 1

a_{P1} = 40 dB
a_{P1} = 30 dB
L_{P1} = -10 dB

a) Compute the power amplification factor g_{P1} of the amplifier, assuming that the signal power level required at the input is L_{P2} = -20dBm.
b) At the input of the amplifier a voltage level L_{U2} = -40dB is measured. Which is thus, the input resistance R_E of the receiver?
c) As a result of a nonlinear characteristic the intermediate amplifier produces harmonics. Consequently, the signal at the output of the amplifier features the distortion factors k_1 = 20% and k_2 = 10%. Determine the relationship between the wanted signal power (fundamental wave) and the disturbing signal power (harmonics).

Subject 2:

A frequency band from 300 Hz to 4 kHz has to be transmitted with a PCM Transmitting System.

a) Specify the minimal needed sampling frequency f_s so that the transmitted signal remains undistorted?
b) In this case, which is the bit-rate R_b for a 4-bit encoding?
c) Which is the necessary frequency band for this transmission?
d) Specify an analog Pulse-Modulation technique and sketch the associated modulated time-signal.