The Open University of Sri Lanka
Department of Electrical and Computer Engineering
Final Examination 2005 / 2006
ECD1205 - Introduction to Radio and Line Communication

Time: 0930 – 1230 hrs. Date: 2006-03-30

Answer any FIVE questions

1.

(a) What is the role of *carrier frequency* in modulation?.

(b) A sinusoidal carrier is amplitude modulated using a sinusoidal information signal. The maximum- and the minimum peak-peak amplitudes of the modulated carrier is 4 V and 3 V respectively. Find the depth of modulation.

(c) A 80 kHz sinusoidal carrier is amplitude modulated using a 10 kHz sinusoidal signal. Sketch the frequency spectrum of the resulting signal.

(d) Sketch an over modulated a.m. signal (depth of modulation >100%). Assume that both the carrier and the modulating signal are sinusoidal.

2.

(a) A 100 kHz carrier is frequency modulated using a 20 kHz modulating signal. Sketch the resultant waveform.

(b) (i) What is the theoretical bandwidth of a f.m. signal?
(ii) How would you calculate the approximate practical bandwidth of a f.m. signal?

(c) The maximum- and minimum frequencies of a frequency modulated carrier is

100 kHz and 120 kHz. Find

(i) the carrier frequency
(ii) the modulation index
(iii) the deviation ratio.

3.

(a) Define
(i) dBm
(ii) dBW

(b)

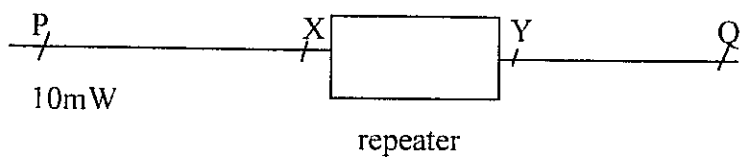

Fig.3

A signal is transmitted from P to Q on a long distance telephone line. At a distance of 80 km from P a repeater is situated. The power level at P is 10 mW. Power gain of the repeater is 100. If PQ = 160 km and the attenuation of the telephone line is 0.03 dB/km, calculate power levels at X, Y and Q in dBm.

4.

(a) What are the basic parameters of a transmission line?

(b) A lossless transmission line has L = 2 mH / km and C = 10 nF / km. Find

(i) the characteristic impedance (Z_0) of the line.
(ii) the phase velocity.

(c) (i) What is the reflection coefficient at a matched load?
(ii) The reflection coefficient at a certain point of a transmission line was measured to be 0.2. Calculate the VSWR (Voltage Standing Wave Ratio).

5.

(a) Why is it necessary to keep the distance between the reflector and the dipole of a domestic antenna at 0.25λ ?

(b) The frequency of a certain VHF TV channel is 300 MHz. It is necessary to design a receiving antenna for this channel. Calculate the length of the dipole. (Speed of an electromagnetic wave in free space is 3.10^{10} cm / s) .

(c) *The radiation resistance* of an antenna is 70Ω . If the efficiency of the antenna is 80%, find *the loss resistance.*

6.

(a) Briefly describe the following:

(i) radiation pattern
(ii) front-to-back ratio
(iii) directivity of an antenna

(b) A short *ribbon type* feeder cable is used for a built in TV antenna. Why is *coaxial type* feeder cable not used here?

(c) What is understood by *beam-width* of an antenna?
You are given the plot of a radiation pattern of an antenna. With the help of a sketch explain how you would calculate the *beam-width* of the antenna.

7.

(a) Briefly explain
(i) *tropospheric wave*
(ii) *ionospheric wave.*

(b) A transmitting antenna and a receiving antenna are situated on the ground. The heights of the transmitting and the receiving antenna from the ground level are h_t and h_r respectively. It was found that the maximum usable distance (d) between the two antennae is restricted by h_t and h_r.
(i) Why does d depend on h_t and h_r?
(ii) The maximum usable distance can be expressed as
$d = 3550[\sqrt{h_1} + \sqrt{h_2}]\ meters$. If the difference of antenna heights is 80 m, find the heights of transmitting- and receiving antennae from the ground level. The transmitting antenna covers a circular area with a radius r = 50 km on the earth surface.

8.

Briefly explain the following:

(a) critical frequency

(b) skip distance.

(c) frequency division multiplexing (only the principle)

(d) log periodic array