Department of Electrical Engineering

Subject: Radio Electronics (ELECTIVE V)

Final Assignment

Max Marks: 50

Question. 1 (15)

i. How can a divide-by-two architecture can help reducing some of the problems of DC transmitter?
ii. What is the optimal impedance for high power and high voltage transmission over a long distance and how is this number obtained?
iii. Determine the height of antenna required to transmit the following two signal over a distance of 10 kilometers. Based on obtained results, discuss the need for modulation

   a. $2.5\cos 5\times 10^{3}\pi t$
   b. $7.35\cos 2.25\times 10^{6}\pi t$

Question. 2 (10)

Direct conversion Transmitters have issues of I/Q mismatch, Carrier leakage, Mixer linearity, TX linearity and Oscillator pulling. Discuss the effects of all these mentioned issues with the help of illustrations and mathematical models.

Question. 3 (10)

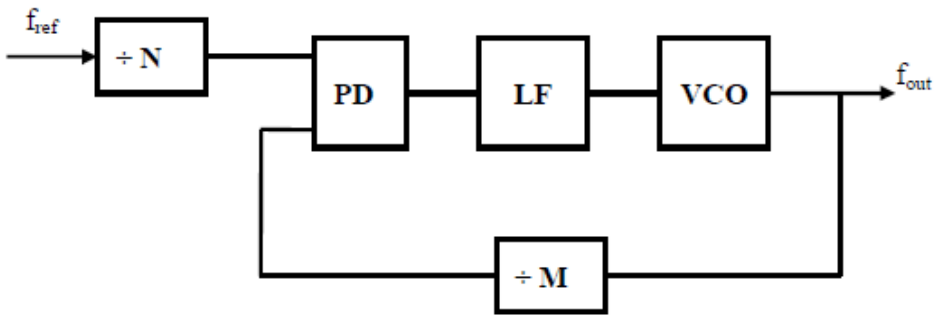
i. An analog multiplier "mixes" its two inputs below, ideally producing $y(t) = kx_1(t)x_2(t)$, where k is a constant. Assume $x_1(t) = A_1 \cos \omega_1 t$ and $x_2(t) = A_2 \cos \omega_2 t$.
   a. If the mixer is ideal, determine the output frequency components.
   b. If the input port sensing $x_2(t)$ suffers from third-order nonlinearity, determine the output frequency components
ii. Determine the PM and FM signals in response to
   a. $x_{BB}(t) = A_0$
   b. $x_{BB}(t) = \alpha t$

Question.4 (15)

The frequency table for different GSM bands is shown below:

Band	Uplink (MHz)	Downlink (MHz)
GSM 850	824 – 849	869 – 894
GSM 900	876 – 915	921 – 960
GSM 1800	1710 – 1785	1805 – 1880
GSM 1900	1850 – 1910	1930 – 1990

Each band comprise of channels, which are spaced 200kHz apart (for example GSM 850 uplink band have channel center frequencies at 824.0, 824.2, 824.4, …, 848.8, 849.0MHz). We want to use a PLL to generate the center frequencies for all channels in all four bands.



Calculate the range of the division factors N and M if the reference frequency (fref) is 8MHz (generated from a crystal oscillator). Assume the factors N and M have to be integers.