UNIVERSITY OF JOHANNESBURG

PROGRAM	:	B TECH *ELECTRICAL ENGINEERING*
SUBJECT	:	**Radio Engineering IV**
CODE	:	**EER411**
DATE	:	WINTER EXAMINATION 6th JUNE 2014
DURATION	:	08:30 - 11:30
WEIGHT	:	40 : 60
TOTAL MARKS	:	100

EXAMINER	:	DR B. S. PAUL
MODERATOR	:	Mr. J. SEBASTIAN
NUMBER OF PAGES	:	3 PAGES

INSTRUCTIONS TO CANDIDATES:

1. ANSWER ALL THE QUESTIONS.
2. CALCULATORS MAY BE USED.
3. FIGURES MAY BE DRAWN WHEREVER NECESSARY TO SUPPORT THE ANSWERS.

QUESTION 1

For a parabolic dish antenna at 12 GHz having a beam width of 2°

1.1 Calculate the diameter of the parabolic dish.
1.2 If 65% efficient, evaluate the antenna gain.

(4+6)

QUESTION 2

Three analog signals from three sources are being multiplexed in time domain. The maximum signal frequencies for the three input signals are $f_{A1}(\max) = 10\,KHz$, $f_{A2}(\max) = 20\,KHz$ and $f_{A3}(\max) = 50\,KHz$.

2.1 Find the minimum multiplexing frequency so that aliasing error can be avoided for all the signals.

2.2 Calculate the length of the frame.

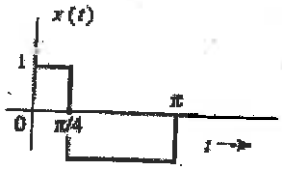
2.3 Calculate the number of pulses generated each second.

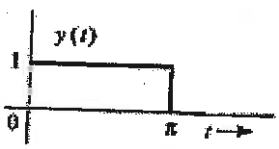
(3+3+3)

QUESTION 3

3.1 Find E_x and E_y, the energies of the signals $x(t)$ and $y(t)$ shown in the figure below.

3.2 Sketch the signal $x(t)-y(t)$ and $x(t)+y(t)$ and show that whether the energies of either of these two signals are equal to $E_x + E_y$.





(2+3+2+2+3+3 = 15)

3/...

QUESTION 4

Evaluate the bandwidth that contains 65% of the energy for the signal $f(t) = u(t)e^{-t}$

$\left[N.B.\ \frac{d}{d\omega}\left[\tan^{-1}(\omega)\right] = \frac{1}{1+\omega^2}\right]$

(10)

QUESTION 5

With the help of suitable circuit diagrams and sketches, explain the working of a pulse-width modulator circuit.

(10)

QUESTION 6

6.1 With the help of a suitable block diagram explain the working of a Phase Lock Loop.
6.2 Comment on the different ranges in the operation of a Phase Lock Loop.

(6+4)

QUESTION 7

Fifty-two (52) different items are required to be encoded.

7.1 How many bits are required to completely distinguish all the items?
7.2 What is the coding efficiency of the system?
7.3 What is the efficiency if base-8 coding system is used?

(3+3+4)

QUESTION 8

Sketch and explain the operation of a pulse amplitude modulator circuit with flat top sampling.

(8)

QUESTION 9

With the help of block diagram and necessary sketches explain the functioning of a Direct Sequence Spread Spectrum System.

(10)

QUESTION 10

A time domain signal $g(t)$ has a Fourier transform of $G(\omega)$. Find the energy of the signal in terms of $G(\omega)$.

(8)

[Total Marks: 100]