ROLL NO.									

B.E. / B.TECH (FULL TIME) END SEMESTER ARREAR EXAMINATIONS APRIL/MAY 2013
ELECTRONICS AND COMMUNICATION ENGINEERING BRANCH
FIFTH SEMESTER REGULATIONS : 2008
EC 9027 INFORMATION THEORY

35

Time 3 hr **Max Marks 100**

Answer All Questions

Part-A (10x2=20 Marks)

1. Define Kullback Leibler Distance.
2. A discrete data source produces messages from a set $\{x_1, x_2, x_3, x_4\}$ where the probabilities associated with the messages are $p_2 = ¼$, $p_3 = 1/8$ and $p_4 = 1/8$. Find the entropy.
3. State Kraft inequality.
4. List the properties of an optimal Huffman codes.
5. Find the channel capacity of Binary symmetric channel.
6. State source-channel coding theorem.
7. Give the relation between Differential Entropy and Discrete Entropy.
8. Find the capacity of a Gaussian channel with power constraint P and noise variance N.
9. Compare Multiple access channel and Broadcast channel.
10. What is a Gaussian Multiple access channels.

Part-B (5x16=80 Marks)

11. (a)(i) Two discrete random variables X and Y have binary outcomes defined as $x_1 = 0$, $x_2 = 1$, $y_1 = 1$ and $y_2 = 1$. The joint probabilities of x and y are given as $P(x_1, y_1) = ¼$, $P(x_1, y_2) = ¼$, $P(x_2, y_1) = ½$, $P(x_2, y_2) = 0$. Find the self entropies H(x) and H(y), the joint entropy H(x,y) and the conditional entropy H(x/y). **(8)**

(ii) For the BSC, with a transition probability below, find mutual information assuming that the input symbols are equiprobable. **(8)**

$$P(y/x) = \begin{bmatrix} 1-p & p \\ P & 1-p \end{bmatrix}$$

12.(a) Discuss the Data Compression techniques in detail. **(16)**

OR

12.(b)(i) Explain the Asymptotic equipartition property in detail and derive its codeword length. **(10)**

(ii) A discrete memoryless source has an alphabet of five symbols S_1, S_2, S_3, S_4 and S_5 in the probabilities {0.55, 0.15, 0.15, 0.10, 0.05}. Encode the symbols using Huffman coding technique and find the efficiency. **(6)**

13.(a)(i) Discuss the join source channel coding theorem with neat block diagram. **(8)**

(ii) Find the channel capacity of the binary erasure channel. **(8)**

OR

13.(b)(i) Discuss the capacity of a discrete memoryless channel with feedback. **(8)**

(ii) The joint probability matrix is given below. Determine the channel capacity. **(8)**

$$P[a,b] = \begin{array}{c} \\ a_1 \\ a_2 \\ a_3 \\ a_4 \end{array} \begin{array}{c} \begin{array}{ccc} b_1 & b_2 & b_3 \end{array} \\ \begin{bmatrix} 0.25 & 0 & 0.1 \\ 0 & 0.3 & 0.05 \\ 0.1 & 0.05 & 0 \\ 0 & 0 & 0.15 \end{bmatrix} \end{array}$$

14.(a) Discuss in detail about the Band-limited channels. **(16)**

OR

14.(b) Describe the Gaussian channels with feedback with neat diagram. **(16)**

15.(a) Describe the capacity of various types of multiple access channel. **(16)**

OR

15.(b) Write short notes on

(i) Gaussian Interference channel **(8)**

(ii) Gaussian two way channel **(8)**

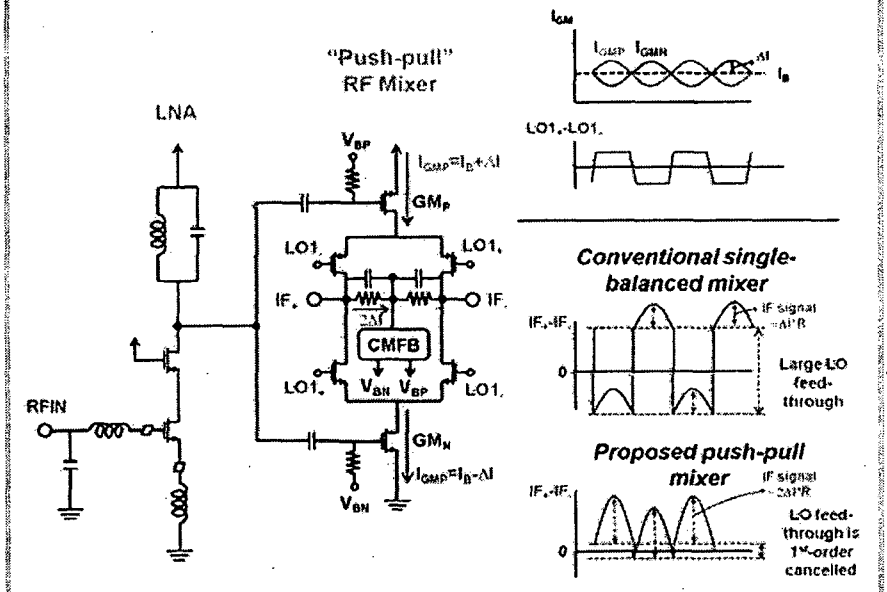

Figure 6 The simplified schematic of the RX front-end, and the concept illustration of the push-pull mixer with an example of zero IF.

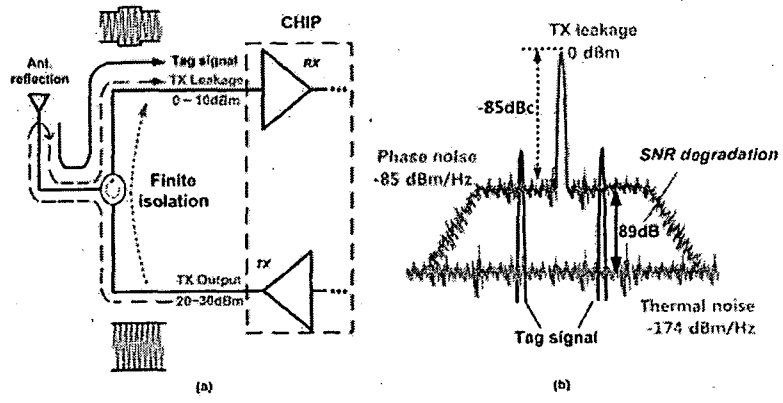

Figure 7 (a) Leakages and signal in RFID system and (b) sensitivity degradation by leakage.

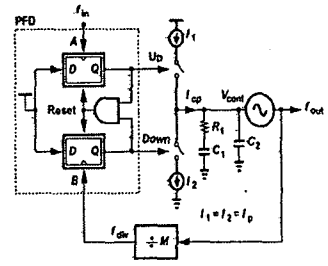

Fig. 8 A PFD in an integer-N PLL.

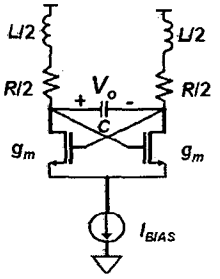

Fig.9a

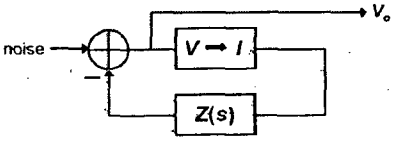

Fig.9b

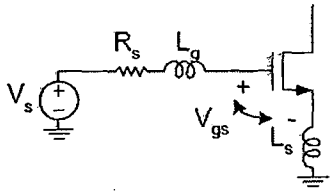

Fig.10

Note:
Figure in (Q11a) is from IEEE JSSC, April 2013 pp1072.
Figures (Q11 b and Q11c) are from IEEE JSSC, Dec 2012 pg2943
Figure in (Q12a) is from IEEE ISSCC Feb 2013, pp 446
Figure in (Q12b) is from IEEE ISSCC Feb 2013, pp 92
Figure in (Q13a) is from IEEE TCAS I Mar 2013 pp 529