FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

BACHELOR OF ENGINEERING PROGRAMME, YEAR 4 (BENG 4)

EEE 793 COMMUNICATION THEORY

FINAL EXAMINATION
(SEMESTER 1, 2016)

Duration – 3 Hour

DATE/TIME/ROOM – Refer to Timetable

INSTRUCTIONS TO CANDIDATES

1. You are allowed 10 minutes extra time during which you are not to write.
2. Begin each answer on a fresh new page and use both sides of the sheets.
3. Write your identification number on the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper etc. in their correct sequence and secure with string provided.
5. For all sheets of paper in which rough work has been done, cross it through and you must attach to your answer script.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. ANSWER ONLY TEN QUESTIONS. **(All Questions carry 10 Marks)**

Total no of pages – 4 (including cover page)

Question 1

Define Shannon Hartley theorem and derive the channel capacity of a white band limited Gaussian channel.

Question 2

Explain the process involved in Quantization and derive the signal to noise ratio of uniform quantization.

Question 3

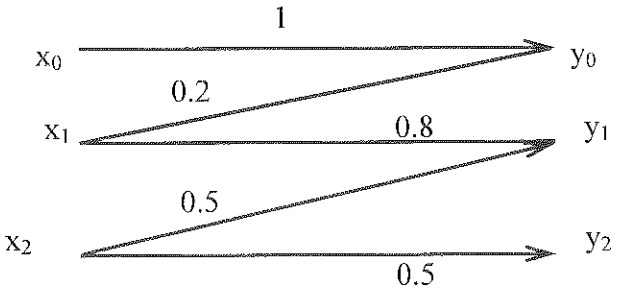
Explain the following

a. S/N bandwidth tradeoff

b. Average and entropy (joint and conditional)

Question 4

A discrete source transmits symbols x_0, x_1, and x_2 with the probabilities 0.3, 0.3 and 0.4. The transition probabilities are given by Figure 1 below:



i) Figure 1

Find the channel matrix $\mathbf{P(Y|X)}$ and calculate the output symbol probabilities $p(y_0)$, $p(y_1)$ and $p(y_2)$.

Question 5

The first stage of a two stage amplifier has a voltage gain of 10, a 600Ω input resistor, a 1600dB equivalent noise resistance and a 27kΩ output resistance. For the second stage, these values are 25.81 kΩ, 10KΩ and 1MΩ respectively. Calculate the equivalent input noise resistance of this two stage amplifier.

Question 6

With suitable block diagram and waveforms, explain the working principle of

a) Direct sequence spread spectrum system and
b) Frequency Hopping spread spectrum system.

Question 7

Explain with suitable diagrams the different blocks present in an OFDM transceiver and explain the significance of each block. Show the impact of increasing the number of sub-carriers on the power spectral characteristics of the OFDM signal.

Question 8

a. Discuss the External noises associated in receiver systems.
b. An Amplifier operating over the frequency range from 18 to 20 MHz, has a 10KΩ input resistor. What is the rms noise voltage at the input to this amplifier if the ambient temperature is 27°C?

Question 9

Consider the discrete memory less source with source alphabet

$S = \{s_0, s_1, s_2\}$ with $p_0 = 1/4$, $p_1=1/4$ and $p_2=1/2$.

Prove that $H(S^2) = 2\ H(S)$.

Question 10

a. Draw the block diagram of 5 tap linear traversal equalizer and explain the LMS algorithm to update the weights.
b. Explain the Zero forcing algorithm and discuss about its pros and cons

Question 11

Why does Inter-Symbol Interference (ISI) occur in a communication channel? Discuss the Nyquist's criterion for pulse shaping to reduce ISI. Compare the merits and demerits of the Ideal Sine pulse shaping and the Raised cosine pulse shaping solutions.

Question 12

Explain the basic concept of orthogonal frequency division multiplexing (OFDM) channel partitioning.

Question 13

Define sampling theorem. Express mathematically the Nyquist's Criterion for pulse shaping to tackle Inter-Symbol Interference.

THE END