Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	DIGITAL COMMUNICATION
COURSE CODE	:	BEB 41803
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Given an analog signal $x(t)$ of **Figure Q1(a)**. Determine its discrete version signal using sampling time as 0.1s.

(6 marks)

(b) Calculate quantize version signal of x using 8 quantization level with its amplitude range from -3.5 to 3.5.

(6 marks)

(c) Predict the digital signal of $x(t)$.

(8 marks)

Q2 (a) A client proposed a project to construct a (7, 4) Hamming code for the message (1000). As an engineer you are assigned to this project and you will need to consider even parity in your design. Show step by step the calculation process.

(10 marks)

(b) A code was received as 0010001

i. Check if this received code is correct.

(3 marks)

ii. If there is an error, determine which bit has error.

(3 marks)

iii. Predict the corrected code.

(4 marks)

Q3 (a) Suppose the letters a, b, c, d, e, f have probabilities 1/2, 1/4, 1/8, 1/16, 1/32, 1/32 respectively. What is the average length of Huffman codes of these letters?

(3 mark)

Which of the following is the Huffman code for the letter a, b, c, d, e, and f?

i) 0, 10, 110, 1110, 11110, 11111
ii) 11, 10, 011, 010, 001, 000
iii) 11, 10, 01, 001, 0001, 0000
iv) 110, 100, 010, 000, 001, 111

(1 mark)

(b) Generate Huffman codes for the following messages:

i) a b c a c b d a a b d e f b using probabilities in **Q3(a)**.

(6 marks)

ii) FKEE UTHM MALAYSIA

(10 marks)

Q4 (a) Calculate and plot sinewave signal of 1 Hz and 3 Hz using sampling frequency of 10 Hz. By using these signals calculate and plot modulation signal of FSK for digital data of "**101**"

(12 marks)

(b) A software designer decided to write a programmme (4, 3) even-parity error-detection code such that the parity symbol appears as the leftmost symbol of the codeword. Compute the probability of an undetected message error, assuming that all symbol errors are independent events and that the probability of a channel symbol error is $p = 10^{-3}$. Which error patterns of the designer programme can the code detect?

(8 marks)

Q5 (a) In general terms, throughput is the rate of production or the rate at which something is processed. State **THREE (3)** ways to increase the throughput (total data rate) of a communication system.

(3 marks)

(b) C.D.M.A (Code-Division Multiple Access) refers to any of several protocols used in second-generation (2G) and third-generation (3G) wireless communications. Sketch the basic block diagram of C.D.M.A signal generation.

(4 marks)

(c) Based on your knowledge, complete the following table:

	Advantages	Disadvantages	System
F.D.M.A	No dynamic coordination. Simplicity.		Analog cellular systems - 1G.
T.D.M.A		Requires precise synchronization.	Digital cellular system - 2G
C.D.M.A	The highest spectrum efficiency.	The highest complexity.	

(3 marks)

(d) Demonstrate data transmitted and received for the following data sequence, "1111111100000000" and spreading code of a C.D.M.A system.

(10 marks)

-END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020 PROGRAMME CODE : BEJ
COURSE NAME : DIGITAL COMMUNICATION COURSE CODE : BEB41803

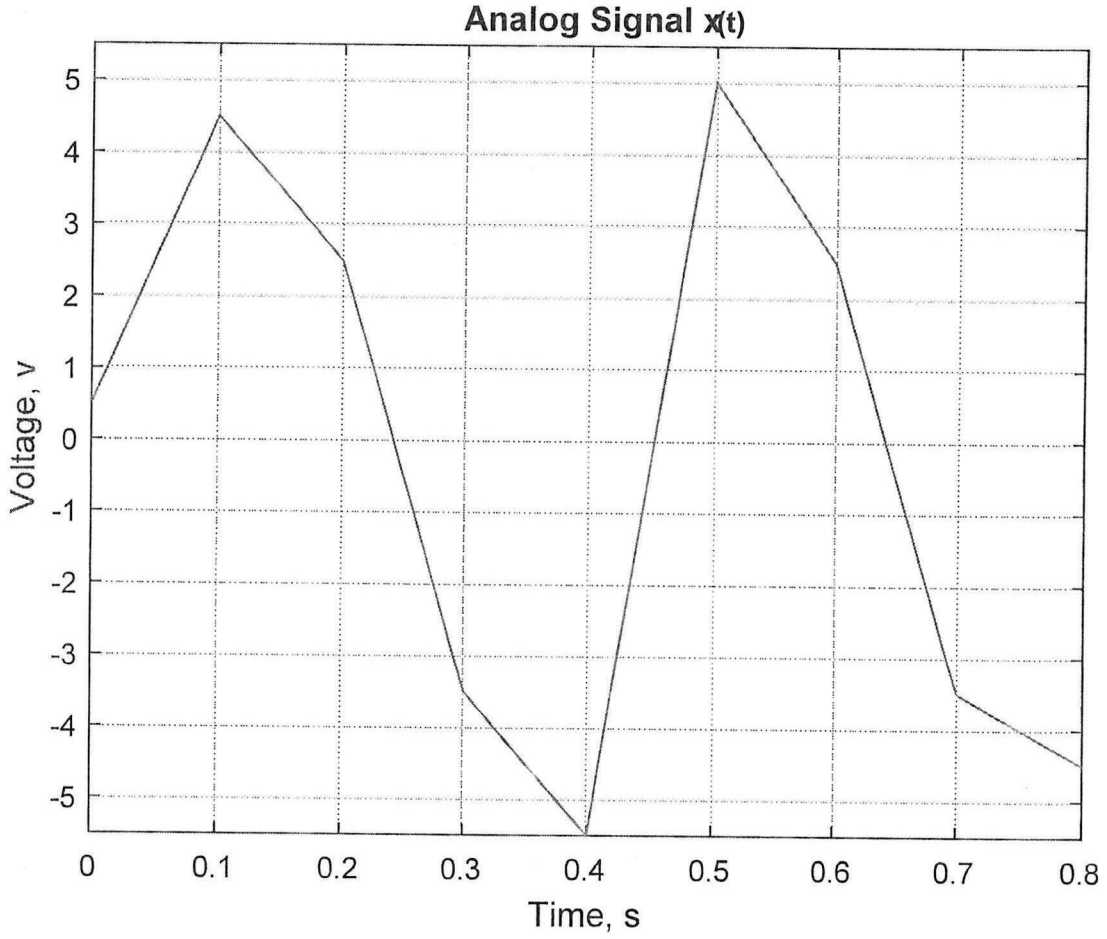

Figure Q1(a)