THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND COMMUNICATIONS ENGINEERING

FIRST SEMESTER EXAMINATION (2022)

EE412 / 511: INFORMATION THEORY & CODING (BEEC/4)

TIME ALLOWED: 3 HOURS

INFORMATION FOR STUDENTS

1. You have **TEN (10) MINUTES** to read the paper.
   You must not begin writing during this time.

2. All answers must be written in the **ANSWER BOOK** supplied. **COMPLETE THE DETAILS REQUIRED ON THE FRONT COVER OF YOUR ANSWER BOOK - DO THIS NOW**.

3. Only drawing instruments and calculators are permitted on your desk.

4. Answer all questions.

5. Total available mark is 50.

6. If you are found cheating in the Examination, the penalties specified by the University shall apply.

7. **TURN OFF** all mobile phone and place them on the floor under your sit before the start of examination.

QUESTION ONE [3+2+2+2+2+2+2 = 15 MARKS]

Let's X and Y having following joint distribution of probabilities

X \ Y	0	1
0	1/2	1/4
1	0	1/2

Calculate the entropies (Show full Working):

a) H(X)
b) H(Y)
c) H(X,Y)
d) H(Y|X)
e) H(X|Y)
f) D(X||Y)
g) D(Y||X)

QUESTION TWO [5+10 = 15 MARKS]

A BSC has the following noise matrix with source probabilities of $P(X_1) = 5/12$ and $P(X_2) = 7/12$

$$P(Y/X) = \begin{array}{ccc} & Y1 & Y2 \\ X1 & 3/5 & 2/5 \\ X2 & 2/5 & 3/5 \end{array}$$

A) Calculate H(X) and H(Y) and shows full working.
B) Calculate the channel Capacity and shows full working.

QUESTION THREE [2+2+2+2+2 = 10 MARKS]

Consider the following data and answer the below questions on the concept of Hamming code: 1011001

a) How many redundant bits will be added in the given data?
b) On what positions the redundant bits will be placed in the data?
c) What will be the value of redundant bits?
d) Generate the hamming code for the above given data?
e) Explain the importance of Hamming code as error correction method?

QUESTION FOUR [5+5 = 10 MARKS]

Explain the following:

a) Noiseless Channel
b) Binary Symmetric Channel
c) Deterministic Channel