Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	DIGITAL COMMUNICATION
COURSE CODE	:	BEJ 41103
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS

INSTRUCTION

1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSED BOOK**
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Next-generation wireless access networks will require low-cost and high-capacity deployment to meet customer demand. Discuss why digital transmission is a promising solution in the context of 5G ultra-reliable low latency communications (URLLC).

(10 marks)

(b) Consider that a 100 kbps data stream transmitted on a voice-grade telephone circuit with a bandwidth of 3 kHz. Determine the possibility of acquiring error-free transmission with a signal-to- noise ratio (SNR) of 10 dB. If it is not possible, suggest **TWO (2)** system modifications that might be made.

(5 marks)

(c) Coordinated Multipoint (CoMP) technology in LTE-Advanced allows multiple cells to cooperate and can be seen as a virtual multiple input multiple output (MIMO) system. Compare 8×8 conventional MIMO and 8×8 network MIMO. Provide appropriate block diagrams where needed.

(10 marks)

Q2 (a) Timing error occurs in synchronization as a result of frequency difference between two physically oscillators (transmitter and receiver). Analyze the effects of frequency difference in asynchronous character transmission with data rate of 10 kbps as shown in **Figure Q2 (a)**.

(8 marks)

(b) Energy-efficient wireless network, which emphasizes energy efficiency as well as spectrum efficiency , have been proposed as an effective solution and are becoming the mainstream for future wireless network design. Consider the downlink of a single cell Orthogonal Frequency Division Multiple Access (OFDMA) network consisting of K mobile users. The total bandwidth B is equally divided into N subcarriers.

(i) Identify **TWO (2)** types of diversities available in the network.

(2 marks)

(ii) Discuss the relationship between spectrum-efficient and energy-efficient designs.

(8 marks)

(c) Feedback diversity and maximal ratio combining (MRC) are two classes of space diversity reception methods. As an engineer in a telecommunication service company, you are required to suggest **ONE (1)** method that offers significant benefits to the company. Justify your choice of method in terms of the implementation complexity and resulting fading statistics.

(7 marks)

-END OF QUESTIONS –

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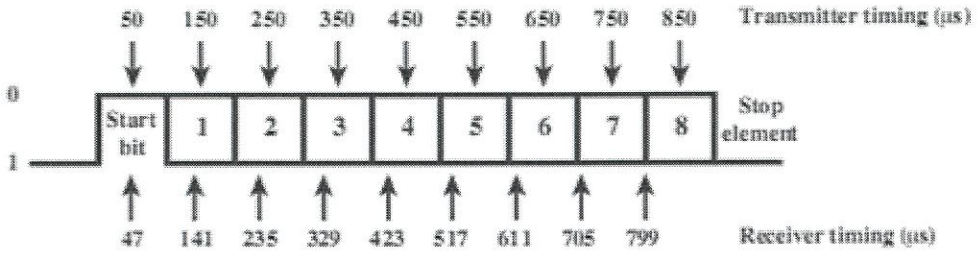

Figure Q2 (a)

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