Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	WIRELESS COMMUNICATION
COURSE CODE	:	BNF 44103
PROGRAMME CODE	:	BNF
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS. **OPEN BOOK EXAMINATION**

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

Q1 (a) Based on your opinion and current understanding, differentiate wireless communication and wired communication in terms of their advantages and disadvantages.

(6 marks)

(b) Describe the differences between radio wave and microwave communication.

(4 marks)

(c) Assume a spectrum of 90 MHz (800 MHz – 890 MHz) is allocated over a base frequency for simplex communication between stations A and B. There are 3 channels for each forward and reverse transmissions

(i) Analyze center frequency and frequency range of each channel
(ii) Illustrate the channel frequency division in block diagram and spectrum form

(10 marks)

(d) Differentiate between half-duplex and full-duplex wireless transmission system.

(2 marks)

(e) Identify the **THREE (3)** modes of wireless propagation

(3 marks)

Q2 (a) By using illustration, demonstrate the following propagation mechanism of radio wave:

(i) Reflection
(ii) Diffraction
(iii) Scattering

(6 marks)

(b) Explain briefly the phenomenon in wireless signal propagation listed below and then, categorize each phenomenon either it occurs in **large-scale** or **small-scale** or both large- and small-scale propagation.

(i) Flat fading
(ii) Shadowing
(iii) Time selective fading
(iv) Knife edge diffraction

(8 marks)

(c) Elaborate **THREE (3)** error mechanism used in mobile communication to mitigate the multipath fading effects.

(6 marks)

(d) An engineer is designing a communications link at 3 GHz where the receiver sensitivity is such that 1 μW of power is needed to overcome receiver noise. The receiving antenna gain is 8 dB, the transmitter antenna gain is 10 dB, the transmitting power level is 25 Watts, and the distance between the two antennas is 1 km. Predict whether the communications link works or not.

(5 marks)

Q3 (a) Analyze the received signal level of a mobile receiver at a distance of 3 km from a base station operating at 950 MHz by using Okumura Hata model. Assume that the propagation is in urban area of a small city (refer **Table Q3 (a)**). The following numerical data is given.

Height of the BTS transmitter = 30 meter
Height of the mobile receive antenna = 2 meter
Power transmit by the base station = 25 Watt
Base station antenna gain = 10 dBi
Mobile receiver antenna gain = ? dBi

(9 marks)

(b) Analyze the average path loss of an indoor retail store if the floor penetration loss is 3.5 dB. The operating frequency is 2100 MHz with a distance of 10 m. Assume that the path loss exponent is 2.18.

(3 marks)

(c) Differentiate between channelization non contention based multiple access and non-channelization-non-contention based multiple access. Give **ONE (1)** example of each case.

(4 marks)

(d) Explain the differences between Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM). Draw suitable diagram to support your answer.

(9 marks)

Q4 (a) Differentiate between orthogonal frequency-division multiplexing (OFDM) and orthogonal frequency-division multiple access (OFDMA).

(4 marks)

(b) Explain **TWO (2)** advantages and **TWO (2)** disadvantages of OFDMA.

(4 marks)

(c) Discuss your understanding on Space Division Multiple Access (SDMA).

(4 marks)

(d) Explain briefly Differential Phase Shift Keying in digital modulation.

(4 marks)

(e) A network provider, Telco Z has a planning to deploy fifth generation (5G) wireless communication network in Pagoh. As a wireless engineer in the company, plan **THREE (3)** promising strategies that should be considered in order to meet the data rate requirements set for 5G network.

(9 marks)

-END OF QUESTIONS –

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Table Q3 (a)

AREA	FORMULAS
Small and medium-size cities	$a(h_m) = (1.1\log(f_c) - 0.7)h_m - (1.56\log(f_c) - 0.8)$ $C = 0$.
Metropolitan areas	$a(h_m) = \begin{cases} 8.29(\log(1.54h_m)^2 - 1.1 & \text{for } f \leq 200 \text{ MHz} \\ 3.2(\log(11.75h_m)^2 - 4.97 & \text{for } f \geq 400 \text{ MHz} \end{cases}$ $C = 0$.
Suburban environments	$C = -2[\log(f_c/28)]^2 - 5.4$.
Rural area	$C = -4.78[\log(f_c)]^2 + 18.33\log(f_c) - 40.98$