Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	WIRELESS COMMUNICATION
COURSE CODE	:	BNF 32903
PROGRAMME CODE	:	BNF
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Explain the differences between point to point communication, multipoint communication and broadcast communication.

(6 marks)

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

(2 marks)

(c) Assume a spectrum of 90MHz (1800MHz - 1890MHz) is allocated over a base frequency for simplex communication between stations A and B. There are 3 channels and it is assume that each channel occupies 30MHz bandwidth. Analyze:

(i) Center frequency of each channel
(ii) Frequency range of each channel

(5 marks)

(d) Identify **THREE (3)** modes of wireless propagation.

(3 marks)

(e) Communication between the base station and mobile station is defined by the standard common air interface (CAI). Describe the CAI.

(4 marks)

Q2 (a) List **TWO (2)** types of channel fading in wireless communication.

(2 marks)

(b) Describe Doppler shift in wireless communication.

(3 marks)

(c) A Volkswagen car with a speed of 200 km/h is moving toward a cellular base station. The driver is calling a friend using a Samsung mobile phone (communication through GSM 1800 MHz). Calculate:

(i) Maximum Doppler frequency
(ii) Time coherence

From the results, identify whether the Doppler effect leads to Time Selective Fading.

(6 marks)

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

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

(4 marks)

(e) An engineer is designing a communications link at 3 GHz where the receiver sensitivity is such that 1μW of power is needed to overcome receiver noise. The receiving antenna gain is 8dB, the transmitter antenna gain is 10dB, the transmitting power level is 25 Watts, and the distance between the two antennas is 1 km. Predict whether the communications link work 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 = 2 dBi

(7 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 meter. 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 briefly the differences between Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM). Draw the diagram to support your answer.

(6 marks)

Q4 (a) By using suitable diagram, demonstrate Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA).

(6 marks)

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

(4 marks)

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

(4 marks)

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

(4 marks)

(e) Give **TWO (2)** advantages of digital modulation.

(2 marks)

Q5 (a) Given a microstrip patch antenna with a width of 240 mm, length of 190 mm and thickness of substrate of 1.6 mm. Assume the operating frequency is 3.5 GHz. Analyze:

(i) Microstrip characteristic impedance
(ii) Radiation resistance of a resonant λ/2 patch

(4 marks)

(b) A transmission line has a characteristic impedance, Z_o of 50 ohm and load impedance, Z_L of 65 ohm. Calculate.

(i) Reflection coefficient
(ii) Return loss
(iii) Insertion loss

(6 marks)

(c) Calculate the impedance matching of a quarter-wave transformer if the characteristic impedance, Z_o is 50 ohm and load impedance, Z_L is 200 ohm.

(2 marks)

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

(4 marks)

(e) Plot the bit error probability, BEP over energy per bit to noise power spectral density ratio, γ_b of coherent BPSK and optimum DBPSK. Assume the range of γ_b is 0 to 12, Q is 5 and permittivity of 4.5.

(4 marks)

- **END OF QUESTIONS** -

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2018/2019 PROGRAMME : BNF
COURSE : WIRELESS COMMUNICATION COURSE CODE : BNF32903

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	$C = -4.78[\log(f_c)]^2 + 18.33\log(f_c) - 40.98$.

Note: The function $a(h_m)$ in suburban and rural areas is the same as for urban (small and medium-sized cities) areas