



**UNIVERSITI KUALA LUMPUR**  
**MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY**

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**FINAL EXAMINATION**  
**JANUARY 2016 SEMESTER**

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**COURSE CODE** : LEB 40903  
**COURSE NAME** : WIRELESS COMMUNICATION  
**PROGRAMME NAME** : BACHELOR OF MARINE ELECTRICAL ELECTRONIC  
(FOR MPU: PROGRAMME LEVEL)  
**DATE** : 27<sup>TH</sup> MAY 2016  
**TIME** : 9.00 AM  
**DURATION** : 3 HOURS

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**INSTRUCTIONS TO CANDIDATES**

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**NOTE:** Instructions below to be edited to suit the needs of the intended course/examination.

1. Please **CAREFULLY** read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of **TWO (2)** sections; Section A and Section B.
4. Answer **ALL** questions in Section A. For Section B, answer **THREE (3)** questions **WITH AT LEAST ONE (1)** question from question 4 or question 5.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English / Bahasa Melayu language **ONLY**.
7. Trigonometry table has been appended for your reference.

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**THERE ARE 8 PAGES OF QUESTIONS, INCLUDING THIS PAGE.**

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## SECTION A (Total: 40 marks)

**INSTRUCTION: Answer ALL questions.**

**Please use the answer booklet provided.**

## Question 1

- (a) Transmitting signal through free space has many challenges. Explain 2 (TWO) challenges to support the user mobility and 2 (TWO) technical challenges in wireless transmission.

(4 marks)

- (b) Manchester encoding (also known as Biphase Code) is a synchronous clock encoding technique used to encode the clock and data of a synchronous bit stream. By using this techniques, produce the signal from the following:-

- a. 1101 0100
- b. 0000 1111

(2 marks)

- (c) Discuss the difference between Manchester encoding as compared to Non-Return-to Zero Codes.

(2 marks)

- (d) An input signal of repeater is made of 150uW of input power and 1.2uW of Noise power. The repeater contributes an additional 48uW of noise and has gain of 20dB. Determine:-

- a. Input signal-to-noise ratio (dB)
- b. Ratio of Power gain
- c. Output signal power
- d. Output noise
- e. Output signal-to-noise ratio (dB)
- f. Noise factor



(12 marks)

**Question 2**

(a) A bit rate of a system increases with an increase of the number of signal levels we use. Consider a noiseless channel with a bandwidth of 4kHz transmitting a signal with 2 signal levels. Calculate the maximum bit rate of the channel.

(3 marks)

(b) Suppose that the spectrum of a communications channel is 3MHz to 4MHz which has the signal-to-noise ratio (SNR) of 24dB.

- i. In the presence of noise, calculate the channel capacity
- ii. If there were no noise, determine the signal levels would be needed to achieve with the channel capacity obtained in Q2 (b)(i).

(6 marks)

(c) In a digital line transmission, a digital-analog-converter (DAC) circuit illustrated in Figure 1 has the following specifications,

Number of bits	8 bits
Accuracy of transmission	$\pm 10\%$ of LSB
Voltage reference	5V

Determine the following:-

- (i) the step size of the circuit
- (ii) the range of the output voltage that carries the input signal of 1000 1000.

(6 marks)



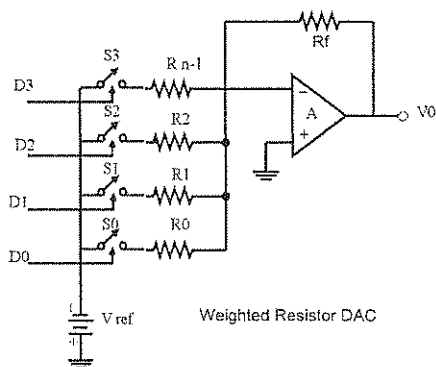


Figure 1

(d) Consider an extremely noisy channel has interfere during transmission which affect signal-to-noise ratio is almost zero. In this case, suggest the value of capacity of the received data.

(5 marks)





## SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) ONLY from FOUR (4) questions.

Please use the answer booklet provided

## Question 3

- (a) In MIMO-OFDM transmission, compare 2 (TWO) theorems of reducing bit-error-rate and increasing signal-to-noise ratio with smart antenna design. Give examples in your answer.

(4 marks)

- (b) The Open System Interconnection is not a protocol itself but a description of how protocols should work. Different protocols accomplish each layer at different tasks. Describe the lowest level of the layer and show its examples.

(5 marks)

- (c) Modulator has well-established in digital communication system in wireless transmission. Explain briefly the need for modulation and demodulation process which they are embedded to the system model. Illustrate them in a complete block diagram.

(6 marks)

- (d)  $\frac{\pi}{4}$  phase shift keying (QPSK) has performed in MIMO OFDM data transmission system. Sketch a complete block diagram that used QPSK modulator in MIMO-OFDM in a system model of wireless communication.

(5 marks)



**Question 4**

- (a) Explain briefly the differences between range-free and range-based methods in determining the location and position of a network users.

(4 marks)

- (b) Determine the 3 (THREE) generic steps in calculating the node position using anchor nodes.

(6 marks)

- (c) Multiple input multiple output (MIMO) is a popular method of transmitting data through wireless link. With the aid of a diagram, explain MIMO's equation that has 2 transmitting antennas and 2 receiving antennas. Assume "j" as an Adaptive White Gaussian Noise (AWGN) that that being utilized in spatial diversity multiplexing.

(5 marks)

- (d) Space Time Trellis Coding has the operation to transmit data 4 states and 2bps/Hz. Sketch 4-PSK constellation diagram to transmit with 2 antennas.

(5 marks)

**Question 5**

- (a) The element that cannot be avoided is noise. Explain the noise interference in wireless transmission and discuss the methods that can eliminate noise during signal transmission.

(5 marks)



(b) Assume that the maximum channel capacity of voice-grade telephone line, with a bandwidth of 12.5 kHz and S/N of 25dB is to be calculated. Determine:-

- i. the theory data rate in bps
- ii. Maximum channel capacity
- iii. Number of coding levels, N needed to achieve the maximum speed.

(6 marks)

(c) The easiest way to correct transmission errors is to retransmit any character or block of data that has an error in it, which will be caused by time consuming and wasteful. The most common method is FEC (forward error correction). Explain FEC and two basic types of FEC are Block Codes and Convolutional Codes.

(5 marks)

(d) The actual sampling rate depends on the application and complexity channel bandwidth. Describe the theory of Nyquist sampling rate with a signal broadcast at 10 kHz.

(4 marks)

### Question 6

(a) Describe the characteristic of Ultra-Wide Band radio in wireless applications. Thus, produce the basic transmitter model equation with typical time hopping format by using pulse position modulation (PPM).

(6 marks)

(b) In positioning Wireless Sensor Network, the node for its physical coordinate or symbolic location can be determined by using Multihop Scheme Estimation and Trilateration. Compare both methods in terms of their basic operation.



(5 marks)

(c) Compare 4 (FOUR) wireless standard in terms of their data rate, modulation scheme and range that established as higher throughput improvements.

(4 marks)

(d) In wireless physical layer 802.11b High Data Rate Direct Sequence Spread Spectrum shows an improvement in standards committee. Discuss the main characteristic for this standard.

(5 marks)

End of question paper.

