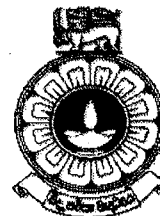


The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical and Computer Engineering



Study Programme : Bachelor of Science Honours in Engineering
Name of the Examination : Final Examination
Course Code and Title : EEX6339 Wireless Communications
Academic Year : 2024/25
Date : 05th March 2026
Time : 13:30 – 16:30 h
Duration : 3 hours

General instructions

1. Read all instructions carefully before answering the questions.
 2. This question paper consists of **Five (5)** questions in **Three (3)** pages.
 3. Answer **all** questions.
 4. All questions carry equal marks.
 5. Answers for each question should commence from a new page.
 6. Attach the question paper with the answers for Question 4 part 1 along with the answer script.
 7. This is a Closed Book Test (CBT).
-

Question 1**20 marks**

1. List the requirements that must be satisfied to ensure line-of-sight propagation in an indoor environment. [06 marks]
2. Consider a wireless network that transmits signals with a frequency $f_c = 900 \text{ MHz}$. Approximate cell radius 10 m and has omni-directional antennas. If the received power of the signal must be at least $20 \mu\text{W}$ for reliable signal reception. Clearly state any assumptions that you make in the following calculations:
 - a. Using free-space path loss model, calculate the minimum transmit power of the signal to ensure reliable signal reception. [08 marks]
 - b. State whether the transmit power varies if the transmission frequency doubles. Prove your answer with appropriate calculations. [06 marks]

Question 2**20 marks**

1. Discuss four (04) limitations of using two-ray model along with practical examples considering both indoor and outdoor wireless communications. [08 marks]
2. Describe two (02) effects of shadowing in cell coverage in a cellular mobile communication network. Use appropriate diagrams to support your answer. [06 marks]
3. Describe two propagation impairments that affect the quality of experience (QoE) of users in satellite television broadcasting networks. Support with suitable practical issues experienced by the viewers. [06 marks]

Question 3**20 marks**

1. Describe the operating principles of a linear equalizer and a decision feedback equalizer (DFE). Compare their performance in the presence of severe ISI and noise, highlighting their respective advantages and limitations. [06 marks]
2. A receiver employs an adaptive equalizer based on the Minimum Mean Square Error (MMSE) algorithm. Explain how this algorithm updates the equalizer coefficients and discuss the roles of step size and training sequence in convergence and steady-state error. [06 marks]
3. In practical deployment, channel conditions vary with time due to user mobility. Discuss how adaptive equalization helps track such variations. What factors limit the ability of an adaptive equalizer to follow fast channel changes? [08 marks]

Question 4**20 marks**

1. Fill in the blanks using appropriate technical terms. [05 marks]

A binary block code generates a block of 'n' coded (a)_____ from 'k' information bits, known as (b)_____ binary block codes. A block code is called a (c)_____ code, when mapping of the 'k' information bits to the 'n' (d)_____ symbols is a linear mapping. If the symbols are transmitted at a rate R_s symbols per second, information rate associated with an (n, k) block code is (e)_____.

2. Compare hard decision decoding and maximum likelihood decoding. [03 marks]
3. Cyclic codes are a sub-class of linear block codes in which all codewords in a given code are cyclic shifts of one another.

- a. If the given codeword is $c = [c_0, c_1, \dots, c_{n-1}]$, then, write the codewords that are shifted by '1' and 'i'. [04 marks]

- b. Consider a (7,4) cyclic code with generator polynomial $g(X) = 1 + X^2 + X^3$. Determine if the codewords described by the following polynomials are valid codewords for this generator polynomial. [08 marks]

i. $c_1(X) = 1 + X^2 + X^5 + X^6$

ii. $c_2(X) = 7 + 2X^2 + X^3 + X^5 + X^6$

Question 5**20 marks**

1. Define the following terms relevant to a wireless communication system. [06 marks]

- a. Antenna diversity
- b. Frequency diversity
- c. Time diversity

2. Describe how spatial multiplexing and diversity gain can be achieved in this 4×4 MIMO deployment. Clearly distinguish between these two concepts in terms of objectives, signal processing, and practical benefits. [08 marks]

3. Compare the operation of a linear combiner and a selection combining mechanism in a wireless communication receiver. [06 marks]

All Rights Reserved