University of Ruhuna - Faculty of Technology

Bachelor of Information and Communication Technology Honours Degree
Level 2 (Semester II) Examination, November/December 2023
Academic Year 2021/2022
Course Unit: ICT2252 – Wireless Communications (Written)

Answer **all four (04)** questions **Duration: 2 hours**

IMPORTANT INSTRUCTIONS

- This paper contains **four (04)** questions on **five (05)** pages.
- The medium of this examination is **English.**
- This is a **closed-book** examination.
- Each question carries an **equal 100** marks.

1)

a) "Wireless communication involves the transfer of information without any physical connection between two or more points". [24 marks]

i) State **two (02)** advantages and **two (02)** disadvantages of wireless communication.

ii) Briefly discuss **two (02)** characteristics of wireless communication.

b) "Wireless network connectivity is a great way to turn a stationary computing system into a mobile computing system". [28 marks]

i) Define **two (02)** basic connection modes of wireless network connectivity and briefly explain them.

ii) Distinguish **four (04)** differences between the connection modes stated in part (b)(i).

c) Briefly describe the term "Ubiquitous Computing" with the aid of **two (02)** examples. [12 marks]

d) "Wired Equivalency Privacy (WEP) and Wi-Fi Protected Access (WPA) are security protocols designed to provide solutions for Wi-Fi network security issues".

[36 marks]

i) List down **four (04)** Wi-Fi network security issues and briefly explain **two (02)** of them.

ii) Distinguish **three (03)** main differences between WEP and WPA.

2)

a) "Wireless Local Area Networks (WLANs) are wireless computer networks that use high-frequency radio waves instead of cables for connecting the devices within a limited area forming LAN (Local Area Network)". Write down **three (03)** basic types of WLAN topologies supported by the IEEE 802.11 standard and briefly explain **two (02)** of them.

[20 marks]

b) "Bluetooth is a short-range wireless technology standard that is used for exchanging data between fixed and mobile devices over short distances and building personal area networks".

[28 marks]

i) List down **four (04)** types of physical channels in Bluetooth.

ii) Identify the **ten (10)** components **(from A to J)** of the Bluetooth protocol architecture shown in Figure Q2.

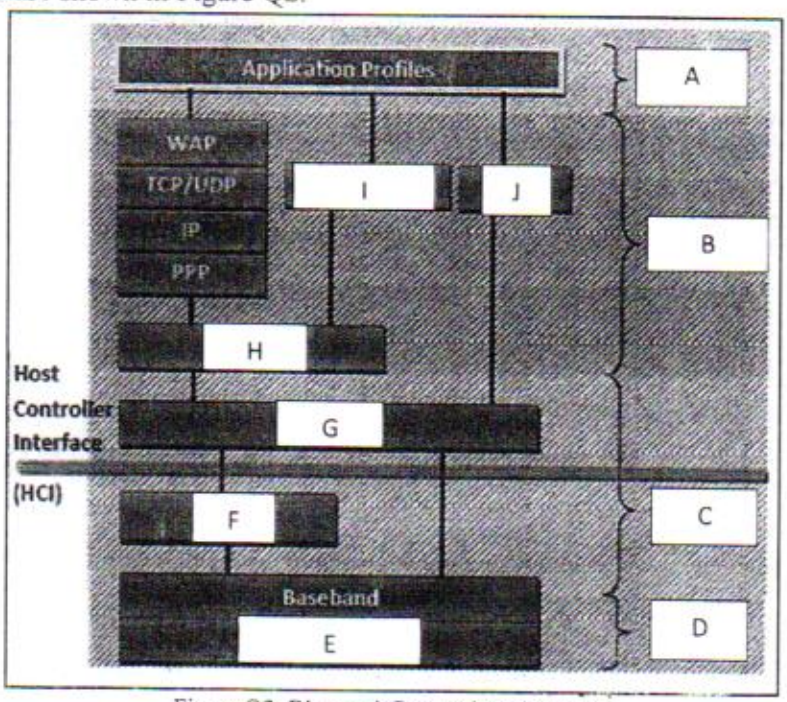

Figure Q2: Bluetooth Protocol Architecture

Source: https://www.tutorialspoint.com/the-bluetooth-protocol-architecture

c) "Carrier-Sense Multiple Access with Collision Detection (CSMA CD) and Carrier-Sense Multiple Access with Collision Avoidance (CSMA CA) are media access control protocols".

[26 marks]

i) Distinguish the main difference between CSMA CD and CSMA CA.

ii) Write down **one (01)** advantage and **one (01)** disadvantage of CSMA CA.

iii) Briefly describe the term "exponential back off" used in media access control protocols.

d) "Orthogonal Frequency Division Multiplexing (OFDM) is a special form of the frequency-division multiplexing (FDM) and multicarrier modulation technique".

[26 marks]

i) Briefly discuss Orthogonal Frequency Division Multiplexing (OFDM) using a real-world example.

ii) "Orthogonal Frequency Division Multiplexing (OFDM) is more efficient than the frequency-division multiplexing (FDM)". Do you agree with this statement? Justify your answer by providing a suitable reason.

3)

a) "Location-based services (LBS) provide targeted information to individuals based on their geographic location in real or near-real time, typically through wireless communication networks".

[20 marks]

i) List down **two (02)** types of Location-based services.

ii) Briefly explain the **two (02)** types of Location-based services stated in part (a) (i) with the aid of a suitable real-world example per each type.

b) "The Global Positioning System (GPS) is an example of positioning technology in location-based services".

[40 marks]

i) State **three (03)** segments of the Global Positioning System (GPS).

ii) Briefly discuss the terms, "Lock or Fix" and "Time to First Fix".

iii) "Assisted GPS (A-GPS) can provide more advantages than GPS". Do you agree with this statement? Justify your answer by providing **three (03)** reasons.

c) There are two nodes named "A" and "B". Consider that "A" is a mobile node and "B" is a correspondent node. Correspondent node "B" wants to transmit an IP datagram to mobile node "A". But at that moment, the mobile node "A" is not available in its home network and it is available in another foreign network called "X".

[40 marks]

i) Describe the process of sending the IP datagram from Correspondent node **"B"** to Mobile node **"A".**

ii) Route optimization allows the correspondent node to learn the current location of the mobile node and tunnel its own packets directly. Write down **two (02)** problems that can arise with this route optimization.

iii) Briefly explain the solution for the problems given in part (a) (ii).

4)

a) "An ad hoc network is a connection topology in which mobile devices connect directly to each other without having a fixed infrastructure".

[34 marks]

i) List down **four (04)** technical challenges in ad-hoc networks.

ii) Describe the hidden node problem in wireless networks.

iii) Explain the process of solving the hidden node problem stated in part (a) (ii).

b) "A wireless sensor network (WSN) is a system designed to remotely monitor and control a specific phenomenon or event".

[32 marks]

i) Compare and contrast a wireless sensor network (WSN) with a wireless ad-hoc network according to the following criteria.

A. Size
B. Power capacity
C. Cost
D. Density and redundancy
E. Sensing of events

ii) Write down **three (03)** characteristics of wireless sensor networks (WSN).

c) "GSM is a telecommunication standard which is used to describe the protocols for second generation (2G) digital cellular networks used by mobile devices and it comprises of many functional units".

[34 marks]

i) Write down **two (02)** main functions of the Mobile Station (MS).

ii) Briefly describe the purpose of using "Abis interface" in the Base Station Subsystem (BSS).

iii) GSM technology was introduced in the second generation (2G) of mobile telephony. List down **two (02)** prominent characteristics of 2G communication.

iv) Distinguish **three (03)** differences between first-generation (1G) and second-generation (2G) wireless communication.

---------- **End of the Paper**----------