

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 5

LEFEL 5

EXAMINATION PERIOD
JULY 2017

CYFNOD ARHOLIADAU
GORFFENNAF 2017

MODULE CODE: M5X01060
Wireless Networks

TIME: 2 HOURS (USE 1 ½ NOT 1.5 FOR TIME)

ANSWER THREE QUESTIONS OUT OF FOUR. EACH QUESTION CARRIES EQUAL MARKS.

Equipment or materials required – Basic Calculator

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ANSWER THREE QUESTIONS

Q1.

- a. State the three security mechanisms that were deployed by the IEEE to protect the security of IEEE 802.11 networks and name the three basic security goals that the security mechanisms provided for data. State these mechanisms in their order of implementation. For example, which one came first, second, and then third.

(9 Marks)

- b. What security weaknesses were discovered in the security mechanisms and why?

(10 Marks)

- c. What was the security enhancement made on each security mechanisms?

(6 Marks)

Q2.

- a. Antenna is an important part of wireless networks, critically evaluate this statement.

(12 Marks)

- b. For a Parabolic reflective antenna with diameter of 2m, operating at 12GHz. Calculate the following: (include all calculation steps)

i. Effective area **(2 Marks)**

ii. The antenna gain **(5 Marks)**

iii. If the wavelength is 3mm, what is the antenna gain for:

1.Parabolic antenna **(3 Marks)**

2.Horn antenna **(3 Marks)**

Note 1: The relationship between antenna gain and effective area is:

$$G = \frac{4\pi A_e}{\lambda^2} = \frac{4\pi f^2 A_e}{c^2}$$

Where

G = antenna gain

A_e = effective area

f = carrier frequency

c = speed of light ($\approx 3 \times 10^8$ m/s)

λ = carrier wavelength

Note 2: Table 1 in relation to antenna gain and effective area

Type of Antenna	Effective Area A_e (m^2)	Power Gain (relative to isotropic)
Isotropic	$\lambda^2/4\pi$	1
Infinitesimal dipole or loop	$1.5\lambda^2/4\pi$	1.5
Half-wave dipole	$1.64\lambda^2/4\pi$	1.64
Horn, mouth area A	$0.81A$	$10A/\lambda^2$
Parabolic, face area A	$0.56A$	$7A/\lambda^2$
Turnstile (two crossed, perpendicular dipoles)	$1.15\lambda^2/4\pi$	1.15

Q3.

You have been commissioned to work with the UWTSD technical team to plan and create a smart campus utilising the concept of the Internet of Things (IoT). Your task is to focus on the smart classroom management. Use the knowledge gained from your Wireless Network assignment to provide the team with the following:

- a. A written document outlining:
 - i. How to automatically count the number of students in the class room
 - ii. How to manage the lights in different classroom (i.e. the lights should be switched off if not being used)
 - iii. How to manage the classroom lights brightness (i.e., lights on darker days should be brighter than sunny days).
 - iv. How to manage blinds and control windows according to the weather condition.
 - v. How to manage the air condition in the room according to the weather requirements.

(15 Marks)

- b. Design a blueprint network architecture model(s) to conceptualise the above points in 3a.

(10 marks)

Q4.

- a. In reference to IEEE 802.11 logical architecture, topologies and physical layer, match each word number to the appropriate definition or term.

(25 Marks)

Words	Definition / Terms	Answers
1. Unacknowledged connectionless services	Provide the services necessary to handle address to destination mapping and seamless integration of multiple BSSs.	
2. Basic Service Set (BSS)	This is when a random back-off procedure is used to resolve medium contention conflicts	

3. Authentication	Logical Link Control and the Media Access Control made up which layer?	
4. Distribute System (DS)	This set of services provides the means for establishing, using, resetting, and terminating data link layer connections.	
5. Integration	Two or more BSSs connected by a common DS	
6. Physical Layer Convergence Procedure (PLCP)	The primary service used by stations to exchange MAC frames when the frame must traverse the DS to get from a station in one BSS to a station in another BSS	
7. Acknowledged connection-oriented services	Network entities can exchange link service data units (LSDUs) without the establishment of a data link level connection.	
8. Privacy	Establishes identity of stations to each other	
9. Reassociation	Enables the delivery of MAC frames through a portal between a distribution system and a non-802.11 LAN	
10. Extended Service Set (ESS)	Enables the delivery of MAC frames through a portal between a distribution system and a non-802.11 LAN	
11. Distribution	In this mode of operation, IEEE 802.11 stations communicate directly. It is often referred as an Ad-hoc network.	
12. Physical Medium-dependent (PMD) System	This procedure defines a method for mapping the MAC sublayer protocol data units (MPDUs) into a framing format suitable for sending and receiving between two or more STAs using the associated PMD system.	
13. MSDU ordering	All stations communicate by way of the AP, and do not communicate directly.	
14. Integration	Establishes initial association between station and AP	
15. Carrier sense multiple access with collision avoidance (CSMA/CA)	The services provided by the MAC sublayer permit, and may require, the reordering of MSDUs.	
16. Distributed Coordination Function	This services provide the means by which network layer entities can reliably exchange LSDUs, but without the establishment of a data link connection	
17. Roaming	Part of the Physical (PHY) layer	
18. Asynchronous data services	Enables transfer of association from one AP to another, allowing station to move from one BSS to another	
19. Association	The services provided by the MAC sublayer permit, and may require, the reordering of MSDUs.	
20. Layer Management Function	Information that is delivered as a unit between MAC	

21. Acknowledged connectionless services	This system defines the characteristics and methods of transmitting and receiving data through a wireless medium between two or more STAs, each using the same PHY system.	
22. MSDU delivery	Association termination notice from station or AP	
23. Disassociation	Prevents message contents from being read by unintended recipient	
24. Independent BSS (IBSS)	What is the fundamental access method of the IEEE 802.11 MAC, carrier sense multiple access with collision avoidance (CSMA/CA), called?	
25. Data Link Layer	The process or ability of a wireless client to move from one cell or BSS to another without losing connectivity to the network.	

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