CENTRAL TEXAS COLLEGE
ITNW-1451
FUNDAMENTALS OF WIRELESS LANS
Semester Hours Credit: 4

INSTRUCTOR: ______________
OFFICE HOURS: ____________

I. INTRODUCTION

A. Designing, planning, implementing, operating, and troubleshooting wireless LANs (WLANs). Includes WLAN design, installation, and configuration; and WLAN security issues and vendor interoperability strategies.

B. The goal of this course is to educate the student about wireless technologies and the implementation of these technologies in wireless networks. Emphasis is placed on the areas of design, planning, implementation, operation and troubleshooting.

C. This course is occupationally related and serves as preparation for careers in computer internetworking and network administration.

D. Prerequisite: ITCC 1306, CCNA2: Router and Routing Basics or ITCC 1404 Cisco Exploration 2 – Routing Protocols and Concepts

II. LEARNING OUTCOMES

Upon successful completion of this course, Fundamentals of Wireless LANS, the student will:

A. Explain wireless technologies, topographies, and standards
B. Design, install, configure, monitor, maintain, and troubleshoot wireless networks
C. Implement wireless security using encryption, MAC filtering, Authentication, Authorization, and 802.1x technologies
D. Discuss radio frequency (RF) technologies
E. Discuss 802.11 regulations and standards
F. Describe 802.11 protocols and devices
G. Implement a 802.11 network
H. Implement 802.11 security
I. Perform 802.11 site survey

June 24, 2013
III. INSTRUCTIONAL MATERIALS

A. The instructional materials identified for this course are viewable through www.ctcd.edu/books.

IV. COURSE REQUIREMENTS

A. Assignment: Complete the lab exercises assigned in each lesson, which can be found in the Fundamentals of Wireless LANS Student Lab Companion book. Complete the quiz at the end of each lesson.

B. Case Study: The case study is found in the Fundamentals of Wireless LANs Student Lab Companion, Lab 12.4.8.1. Submit the completed case study on the due date indicated in the schedule of assignments.

C. Class Performance: Students are required to be in class on time and attend the entire class.

D. Class Participation: Students are expected to be interactive with the instructor during lecture. A question/response format will be used. Class participation is part of your grade.

V. EXAMINATIONS

A. There are three exams for this course. All exams will be taken in class. Exam 1 covers Chapters 1-6; Exam 2 covers Chapters 7-12; and Exam 3 covers Chapters 13-18.

B. If, due to extenuating circumstances, a student is absent and misses the scheduled exam, s/he may make it up at the instructor’s discretion.
VI. SEMESTER GRADE COMPUTATIONS

<table>
<thead>
<tr>
<th></th>
<th>Points</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labs</td>
<td>410</td>
<td>1000 – 900 = A</td>
</tr>
<tr>
<td>Lesson Quizzes</td>
<td>90</td>
<td>899 – 800 = B</td>
</tr>
<tr>
<td>Case Study</td>
<td>200</td>
<td>799 – 700 = C</td>
</tr>
<tr>
<td>Exam 1</td>
<td>100</td>
<td>699 – 600 = D</td>
</tr>
<tr>
<td>Exam 2</td>
<td>100</td>
<td>599 – 0 = F</td>
</tr>
<tr>
<td>Exam 3</td>
<td>100</td>
<td>499 – 0 = F</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1000</td>
<td>1000 Points</td>
</tr>
</tbody>
</table>

VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE INSTRUCTOR

A. Course Withdrawal: It is the student’s responsibility to officially withdraw from a course if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file a Central Texas College Application of Withdrawal (CTC Form 59). The withdrawal form must be signed by the student. CTC Form 59 will be accepted at any time prior to Friday of the 12th week of class during the 16-week fall and spring semesters. The deadline for sessions of the other lengths is the 8th week of 10-week sessions, the 6th week of 8-week sessions, and the 4th week of 5-week sessions. The equivalent date (75% of the semester) will be used for sessions of other lengths. The specific last day to withdraw is published each semester in the Student Bulletin. A student may not withdraw from a class for which the instructor has previously issued the student a grade of “F” or “FN” for nonattendance or “IP” for incomplete.

B. Administrative Withdrawal: You may be administratively withdrawn from any class when your absences exceed a total of four class meetings for a spring or fall semester (or three class meetings for a shorter term); and in the opinion of the instructor, you cannot satisfactorily complete the course.

C. Incomplete Grade: An “IP” grade may be assigned if a student has made satisfactory progress in a course except for a major quiz, final exam, or other project. “IP” may also be used for extenuating circumstances such as personal illness, death in the immediate family, or military orders. Supporting documentation may be required and the student should notify instructors in advance of absence when possible. The instructor may set a deadline for completing remaining requirements—not to exceed 120 days after end of the course. If the work is not completed by the deadline, the “IP” will be converted to an “FI” and appear as an “F” on the student’s transcript.

D. Cellular Phones and beepers: Cellular phones and beepers will be turned off while the student is in the classroom or laboratory.
E. **Americans with Disabilities Act (ADA):** Disability Support Services provides services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Explore the website at [www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support) for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

F. **Instructor Discretion:** The instructor reserves the right of final decision in course requirements.

G. **Civility:** Individuals are expected to be cognizant of what a constructive educational experience is and respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.

VIII. **COURSE OUTLINE**

A. **Lesson One:** Chapter 1

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   
   a. Identify the four industry organizations
   b. Describe the core, distribution, and access layers
   c. Define wavelength, frequency, amplitude, and phase
   d. Describe the concepts of modulation

2. **Learning Activities:**

   a. Read Chapter 1 of text
   b. Review these PowerPoint slideshows: Chapter 1
   c. Test your knowledge by answering the end of chapter review questions.
   d. Use the resources at the textbook website to help you review, remember, and test yourself over the content of the chapter.

B. **Lesson Two:** Chapters 2-4

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:

   a. Describe wavelength, frequency, amplitude, and phase
   b. Describe all the RF propagation behaviors
   c. Describe what causes attenuation
d. Define free space path loss
e. Describe the four possible results of multipath and their relationship to phase
f. Discuss the results of intersymbol interference and delay spread
g. Explain the difference between active and passive gain
h. Explain the difference between transmit and received amplitude
i. Describe the RF components
j. Describe the units of power and comparison
k. Perform RF mathematics
l. Discuss the practical uses of RF mathematics
m. Explain the importance of measuring the SNR and the noise floor
n. Define RSSI
o. Describe the necessity of a link budget and fade margin
p. Compare passive and active gain
q. Identify categories and types of antennas, how they radiate signals, and what type of environment they are used in
r. Describe the Fresnel zone
s. Discuss the concerns associated with connecting and installing antennas and the antenna accessories

2. **Learning Activities:**

   a. Read Chapters 2, 3, and 4 in the textbook
   b. Review these PowerPoint slideshows: Chapter 2, Chapter 3, Chapter 4
   c. Test your knowledge by answering the end of chapter review questions
   d. Use the resources at the textbook website to help you review, remember, and test yourself over the content of the chapter

C. **Lesson Three: Chapters 5 & 6**

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:

   a. Describe the defined spread spectrum technologies of the original 802.11-2007 standard
   b. Define both the required data rates and supported data rates of each PHY
   c. Identify the frequency bands used by each PHY as defined by the 802.11-2007 standard
   d. Explain the three vendor operational modes of ERP (802.11g) and the consequences of each mode
e. Describe the mandatory and optional technologies used in an ERP (802.11g) WLAN
f. Define transmit power control and dynamic frequency selection
g. Explain the defined wireless security standards, both pre-802.11i and post-802.11i
h. Describe the technical specifications of all the ISM and UNII bands
i. Define spread spectrum
j. Identify the similarities and differences between the transmission methods

2. Learning Activities:
   a. Read Chapters 5 and 6 in the textbook
   b. Review these PowerPoint slideshows: Chapter 5, Chapter 6
   c. Test your knowledge by answering the end of chapter review questions.
   d. Use the resources at the textbook website to help you review, remember, and test yourself over the content of the chapter

D. Lesson Four: Chapters 7-9

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
   a. Identify the similarities and differences between CSMA/CA and CSMA/CD
   b. Define the four checks and balances of CSMA/CA and DCF
   c. Define virtual and physical carrier senses
   d. Explain DCF and PCF
   e. Define HCF quality of service mechanisms
   f. Discuss the Wi-Fi Multimedia (WMM) certification and its importance now and in the future
   g. Discuss the importance of airtime fairness and what it does
   h. Describe the four major types of wireless topologies
   i. Explain the four 802.11 service sets
   j. Identify the various ways in which an 802.11 radio can be used
   k. Explain the purpose of the distribution system
   l. Define SSID, BSSID, and ESSID
   m. Describe the various ways in which an ESS can be implemented and the purpose behind each design
   n. Explain access point and client station configuration modes
   o. Explain the differences between a PPDU, PSDU, MPDU, and MSDU
p. Identify the similarities and differences of 802.11 frames and 802.3 frames
q. Identify the three major 802.11 frame types
r. Discuss the media access control (MAC) process and all of the frames that are used during this process
s. Discuss the importance of the ACK frame for determining that a unicast frame was received and uncorrupted
t. Describe the benefits and detriments of fragmentation
u. Discuss the importance of ERP protection mechanisms and how they function
v. Discuss band steering and how it works
w. Describe all of the technologies that make up power management

2. **Learning Activities:**
   a. Read Chapters 7, 8, and 9 of the Textbook
   b. Review these PowerPoint slideshows: Chapter 7, Chapter 8, Chapter 9
   c. Test your knowledge by answering the end of chapter review questions.
   d. Use the resources at the textbook website to help you review, remember, and test yourself over the content of the chapter.

E. **Lesson Five: Chapters 10 & 11**

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   a. Describe the major radio card formats
   b. Explain the need for client adapters to have an operating system interface and a user interface
   c. Identify the three major types of client utilities
   d. Define the three logical network planes of operation
   e. Explain the progression of WLAN architecture
   f. Identify the capabilities of all WLAN legacy infrastructure devices
   g. Identify the capabilities of a WLAN controller solution
   h. Explain the role and configuration of WLAN bridges and workgroup bridges
   i. Explain other WLAN specialty infrastructure
   j. Describe the different WLAN vertical markets
   k. Describe fixed mobile convergence

2. **Learning Activities:**
   a. Read Chapters 10 and 11 of the Textbook
b. Review these PowerPoint slideshows: Chapter 10, Chapter 11
c. Test your knowledge by answering the end of chapter review questions.
d. Use the resources at the textbook website to help you review, remember, and test yourself over the content of the chapter

F. Lesson Six: Chapter 12

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will examine:
   a. Explain the causes and effects of Layer 2 retransmissions
   b. Define dynamic rate switching
   c. Explain the various aspects of roaming
   d. Define the differences between adjacent channel interference and co-channel interference
   e. Explain the differences between MCA and SCA wireless LAN design
   f. Identify the various types of interference
   g. Explain the hidden node problem
   h. Define the near/far problem
   i. Identify performance variables
   j. Discuss the consequences of weather conditions

2. **Learning Activities:**
   a. Read Chapter 12 of the Textbook
   b. Review these PowerPoint slideshows: Chapter 12
   c. Test your knowledge by answering the end of chapter review questions
   d. Use the resources at the textbook website to help you review, remember, and test yourself over the content of the chapter

G. Lesson Seven: Chapters 13 & 14

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   a. Define the concept of AAA
   b. Explain why data privacy and segmentation are needed
   c. Describe legacy 802.11 security
   d. Explain the 802.1X/EAP framework
   e. Define the requirements of a robust security network (RSN)
   f. Describe TKIP/RC4 and CCMP/AES
g. Explain VLANs and VPNs
h. Describe Guest WLAN security
i. Discuss the risk of the rogue access point
j. Define peer-to-peer attacks
k. Identify the risks of eavesdropping
l. Define authentication and hijacking attacks
m. Explain wireless denial-of-service attacks
n. Describe the types of wireless intrusion solutions
o. Describe the need for a wireless security policy

2. Learning Activities:

a. Read Chapters 13 and 14 of Textbook
b. Review these PowerPoint slideshows: Chapter 13, Chapter 14
c. Test your knowledge by answering the end of chapter review questions.
d. Use the resources at the textbook website to help you review, remember, and test yourself over the content of the

H. Lesson Eight: Chapters 15 & 16

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:

a. Define the site survey interview
b. Identify the questions necessary to determine capacity and coverage needs
c. Explain existing wireless network troubleshooting concerns
d. Define infrastructure connectivity issues
e. Identify site survey documentation and forms
f. Explain vertical market considerations
g. Define spectrum, coverage, and application analysis
h. Identify sources of WLAN interference
i. Explain RF measurements
j. Describe AP placement and configuration
k. Identify all site survey tools
l. Explain the two types of coverage analysis

2. Learning Activities:

a. Read Chapters 15 and 16 of the Textbook
b. Review these PowerPoint slideshows: Chapter 15, Chapter 16
c. Test your knowledge by answering the end of chapter review questions.
d. Use the resources at the textbook website to help you review, remember, and test yourself over the content of the chapter.
I. **Lesson Nine:** Chapters 17 & 18

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:

   a. Discuss the history of PoE
   b. Describe the various PoE devices and how they interoperate
   c. Describe the different device classes and the classification process
   d. Define the differences between MIMO and SISO
   e. Define spatial multiplexing
   f. Explain MIMO diversity
   g. Define transmit beamforming
   h. Describe the guard interval
   i. Describe modulation coding schemes
   j. Explain the three HT PPDU formats
   k. Explain HT MAC enhancements
   l. Explain the HT protection modes

2. **Learning Activities:**

   a. Read Chapters 17 and 18 of the Textbook
   b. Review these PowerPoint slideshows: Chapter 17, Chapter 18
   c. Test your knowledge by answering the end of chapter review questions.
   d. Use the resources at the textbook website to help you review, remember, and test yourself over the content of the chapter