ITT Technical Institute

MC2660T

Mobile Wireless Communications II

Onsite Course

SYLLABUS

Credit hours: 4.5

Contact/Instructional hours: 67 (41 Theory Hours, 26 Lab Hours)

Prerequisite(s) and/or Corequisite(s):

Prerequisites: MC2560T Mobile Wireless Communications I or equivalent

Course Description:

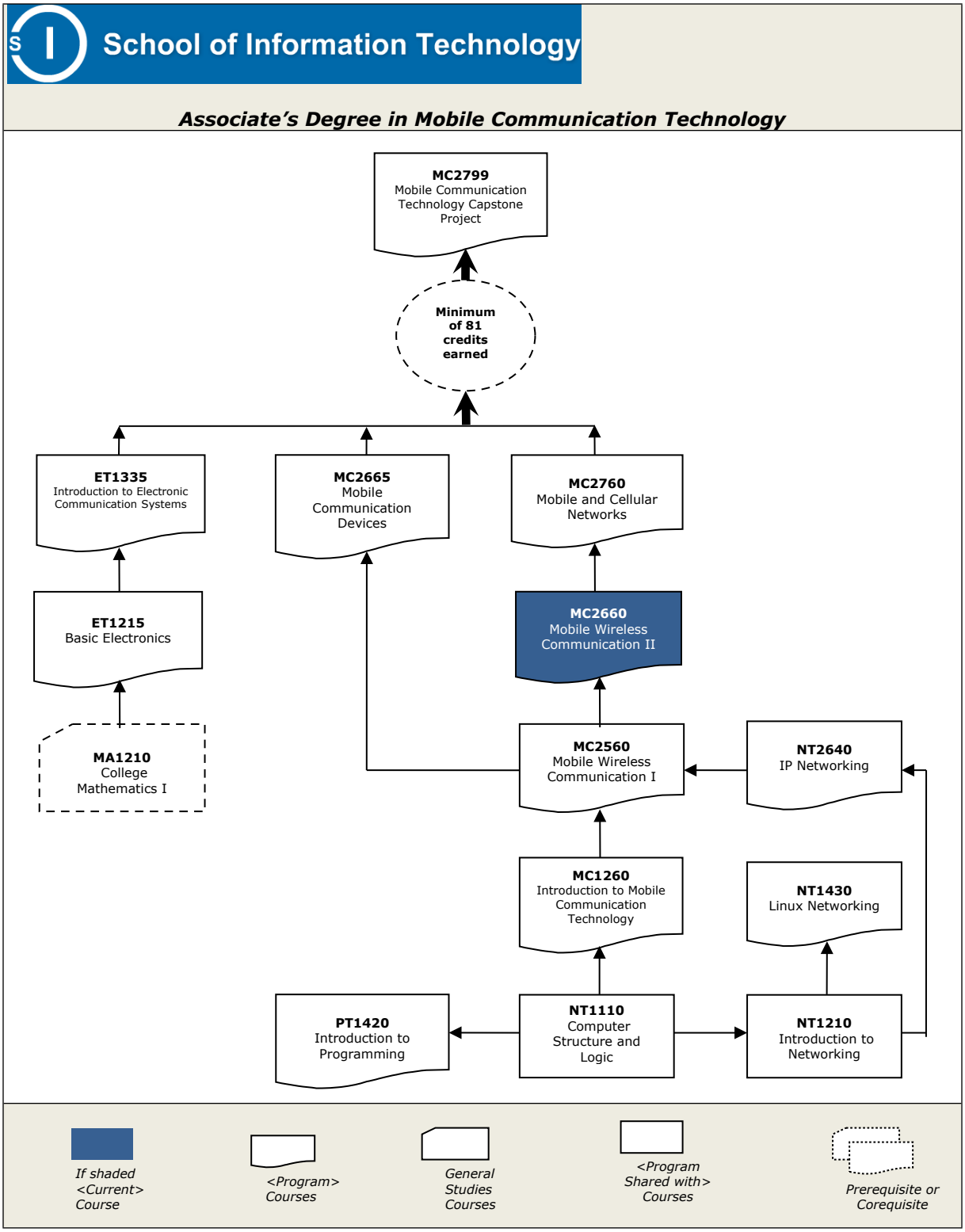
This course involves the study of mobile information systems and wireless communications technology. Topics of study include, but are not limited to, coding for error detection and correction, second-generation, digital, wireless systems, performance analysis, admission control and handoffs, 2.5G and 3G packet-switched wireless systems, access and scheduling techniques in cellular systems, and wireless LAN and personal-area networks.

Where Does This Course Belong?

This course is required for the Mobile Communications Technology program. This program covers the following core areas:

- Basic electronics
- Electronic communications systems
- Computers
- Networking
- Programming
- Mobile wireless communications
- Mobile communications devices

The following diagram demonstrates how this course fits in the program:



Course Summary

Major Instructional Areas

1. Fundamentals of wireless communication
2. Evolution of wireless communications
3. Techniques for ensuring communication integrity, delivery and security
4. Application mobility
5. Advantages and disadvantages of wireless LANs
6. Wireless LAN security
7. Tunneling and packet encapsulation
8. Routing for wireless networks
9. Traditional and mobile TCP
10. Support for mobility and the World Wide Web
11. WiMAX system architecture
12. 4G wireless and beyond
13. Application of RFID and ZigBee technologies

Course Objectives

1. Compare technologies in first generation through fourth generation wireless communication.
2. Explain techniques for ensuring communication integrity, delivery, and security.
3. Explain techniques to provide continuity in wireless communication including handoffs and switched and IP networks.
4. Explain techniques to improve performance in wireless communication.
5. Describe advantages and disadvantages of WLANs.
6. Analyze how security is implemented in IEEE 802.11.
7. Analyze how security is implemented within the Bluetooth standard.
8. Explain how Radio Frequency ID is currently used in the marketplace.
9. Explain the implementation of ZigBee wireless.
10. Explain the purpose of tunneling.
11. Explain the purpose and execution of packet encapsulation.
12. Compare IPv4 technology overview with IPv6.
13. Review routing techniques for wired networks.
14. Compare wireless and wired routing.
15. Discuss issues with TCP performance in wireless environments.
16. Describe the role of WiMAX as a wireless technology.

17. Examine the future of wireless technology.

Learning Materials and References

Required Resources

Textbook Package	New to this Course	Carried over from Previous Course(s)	Required for Subsequent Course(s)
Schiller, J., Grayson, M., et al. (2012). *Mobile wireless communications* (Custom Ed.). Boston, MA: Pearson Education.		■	
	New to this Course	Carried over from Previous Course(s)	Required for Subsequent Course(s)
From ITT Tech Virtual Library> Books> Books24x7: ○ Cache, J. (2010). *Hacking exposed wireless: Wireless security secrets & solutions*. New York, NY: McGraw-Hill. ○ Khan, F. (2009). *LTE for 4G mobile broadband: Air interface technologies and performance*. Cambridge University Press. ○ Miles, S. (2008). *RFID technology and applications.* New York, NY: Cambridge University Press. ○ Rao, R., & Radhamani, G. (2008). *WiMAX: A wireless technology revolution*. Boca Raton, FL: Auerbach Publications.	■		
○			

Recommended Resources

Professional Associations

- American National Standards Institute (ANSI): www.ansi.org
- CDMA Development Group (CDG): www.cdg.org
- Computer and Communications Industry Association (CCIA): http://www.ccianet.org/
- CTIA, The Wireless Association: http://www.ctia.org/
- Defense Advanced Research Projects Agency (DARPA): www.darpa.mil
- European Telecommunications Standards Institute (ETSI): www.etsi.org
- Federal Communications Commission (FCC): www.fcc.gov
- IEEE (Institute of Electrical and Electronics Engineers, Inc.): www.ieee.org
- Internet Assigned Numbers Authority (IANA): www.iana.org
- Internet Society (ISOC): www.isoc.org/isoc/
- Mobile Satellite Users Association (MSUA): www.msua.org

- National Institute of Standards and Technology (NIST): www.nist.gov
- National Technical Information Service (NTIS): www.ntis.gov
- National Telecommunications and Information Administration (NTIA): www.ntia.doc.gov
- Open Mobile Alliance (OMA) & WAP Forum: www.openmobilealliance.org
- Personal Communications Industry Association (PCIA): www.pcia.com
- Portable Computer and Communications Association (PCCA): www.pcca.org
- Satellite Broadcasting & Communications Association (SBCA): www.sbca.com
- Satellite Industry Association (SIA): www.sia.org
- Telecommunications Industry Association (TIA): www.tiaonline.org
- The Computing Technology Industry Association (CompTIA): www.comptia.org
- The Consumer Electronics Association (CEA): www.ce.org
- United States Internet Service Provider Association (US ISPA): http://www.usispa.org/
- United States Telecom Association: http://www.ustelecom.org/
- United States Telecommunications Training Institute (USTTI): www.ustti.org
- Wi-Fi Alliance: http://www.wi-fi.org/index.php
- Wireless Communications Association International (WCAI): www.wcai.com

NOTE: All links are subject to change without prior notice.

Information Search

Use the following keywords to search for additional online resources that may be used for supporting your work on the course assignments:

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- Access methods (wireless)
- ALOHA scheme
- AMPS (Advanced Mobile Phone Services)
- Antenna technology
- Authentication
- CDMA
- Cellular systems
- Frequency-division multiple access
- GSM
- HARQ
- Location-based services
- MIMO
- Mobile Internet Protocol
- UMTS

- WiMAX/Mobile
- Wireless systems

Course Plan

Suggested Learning Approach

In this course, you will be studying individually and within a group of your peers. As you work on the course deliverables, you are encouraged to share ideas with your peers and instructor, work collaboratively on projects and team assignments, raise critical questions, and provide constructive feedback.

Use the following advice to receive maximum learning benefits from your participation in this course:

DO	DON'T
▪ Do take a proactive learning approach. ▪ Do share your thoughts on critical issues and potential problem solutions. ▪ Do plan your course work in advance. ▪ Do explore a variety of learning resources in addition to the textbook. ▪ Do offer relevant examples from your experience. ▪ Do make an effort to understand different points of view. ▪ Do connect concepts explored in this course to real-life professional situations and your own experiences.	▪ Don't assume there is only one correct answer to a question. ▪ Don't be afraid to share your perspective on the issues analyzed in the course. ▪ Don't be negative about the points of view that are different from yours. ▪ Don't underestimate the impact of collaboration on your learning. ▪ Don't limit your course experience to reading the textbook. ▪ Don't postpone your work on the course deliverables – work on small assignment components every day.

Course Outline

Unit 1: WIRELESS LANS, PART 1

Out-of-class work:
5 hrs.

Upon completion of this unit, students are expected to:

- Demonstrate an understanding of the advantages of WLANs.
- Demonstrate an understanding of the disadvantages of WLANs.
- Explain the differences between IrDA and radio transmission.
- Explain how ad-hoc wireless networks are used versus a traditional WLAN.
- Specify the role of frequency hopping within the 802.11 standard.
- Explain how synchronization is achieved in 802.11.
- Describe the role of power management in 802.11.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Schiller and Grayson Part 1, Chapter 7, pp. 225-255	Assignment	Unit 1 Assignment 1: Wireless LAN Technologies	2%
	Lab	Unit 1 Lab 1: Ad Hoc Network	3%

Unit 2: WIRELESS LANS, PART 2

Out-of-class work:
6 hrs.

Upon completion of this unit, students are expected to:

- Explain the differences between 802.11b and 802.11a standards.
- Explain the advantages of HiperLAN/1 and HiperLAN/2.
- Describe the architecture and the purpose of Bluetooth.
- Describe the technique used to make Bluetooth a secure wireless standard.
- Compare the specs of the four major wireless LAN technologies.
- Explain the different ways security is implemented within a WLAN.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Schiller and Grayson Part 1, Chapter 7, pp. 255-321	Assignment	Unit 2 Assignment 1: Wireless LAN Technologies	2%
		Unit 2 Assignment 2: Wireless LANs	2%
	Lab	Unit 2 Lab 1: Bluetooth Technology	3%

Unit 3: EVOLUTION OF WIRELESS COMMUNICATION FROM FIRST GENERATION TO FOURTH GENERATION AND MOBILE IP

Out-of-class work:
11 hrs.

Upon completion of this unit, students are expected to:

- Describe the development of technology and devices from first generation through fourth generation wireless communication.
- Explain the challenges faced in adding mobile devices to the Internet.
- Explain how foreign agents help overcome these challenges.
- Describe the tunneling and encapsulation mechanisms.

- Describe the differences between IPv4 and IPv6.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Schiller and Grayson Part 1, Chapters 4 and 8 • Schiller and Grayson Part 2, Chapter 5	Assignment	Unit 3 Assignment 1: Wireless LANs	2%
	Lab	Unit 3 Lab 1: WLAN	3%
	Quiz	Unit 3 Quiz 1	5%

Unit 4: MOBILE TRANSPORT LAYER

Out-of-class work: *3 hrs.*

Upon completion of this unit, students are expected to:

- Review the basics of TCP.
- Describe how network congestion is dealt with within TCP.
- Explain the role of the supervisory host within M-TCP.
- Describe the fast retransmit mechanism.
- Describe how selective retransmission improves efficiency.
- Explain what configuration parameters are required to adapt TCP to 2.5 and 3G wireless environments.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Schiller and Grayson Part 1, Chapter 9	Assignment	Unit 4 Assignment 1: Review Questions	2%
	Lab	Unit 4 Lab 1: Wireless WLANs	3%

Unit 5: WIMAX

Out-of-class work: *9 hrs.*

Upon completion of this unit, students are expected to:

- Describe the WiMAX architecture.
- Identify the disadvantages of deploying WiMAX in a large city.
- Identify major market players within the WiMAX space.
- Implement a ZigBee wireless network.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Rao & Radhamani, Chapters 1, 3, 5 From ITT Tech Virtual Library. See Required Resources section above for full reference and location.	Assignment	Unit 5 Assignment 1: Local Major Market Players Offering WiMAX Internet	2%
	Lab	Unit 5 Lab 1: ZigBee Wireless Devices	3%
	Quiz	Unit 5 Quiz 2	5%

Unit 6: 4G WIRELESS AND BEYOND: THE FUTURE OF MOBILE COMMUNICATIONS

Out-of-class work:
21 hrs.

Upon completion of this unit, students are expected to:

- Explain the migration from 4G LTE to 4G.
- Identify the major specifications of the 4G standard.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Khan, Chapters 1-2 • Rao & Radhamani, Chapter 6 Both readings from ITT Tech Virtual Library. See Required Resources section above for full reference and location.	Assignment	Unit 6 Assignment 1: Available 4G Networks	2%
	Project ePORTFOLIO	Project Part 1: Project Proposal Summary (Assigned) (ePORTFOLIO)	N/A

Unit 7: MALICIOUS HACKING OF WIRELESS NETWORKS

Out-of-class work:
15 hrs.

Upon completion of this unit, students are expected to:

- Define “hacking” and “malicious hacking.”
- Summarize basic 802.11 hacking techniques.
- Describe how WPA-protected networks are attacked.
- Describe the process of Bluetooth scanning and eavesdropping.
- Describe techniques to ensure data integrity and delivery in wireless communications.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Cache, Chapters 1, 2, 3, 4, 5, 8, and 9 From ITT Tech Virtual Library. See Required Resources section above for full reference and location.	Assignment	Unit 7 Assignment 1: Data Integrity and Delivery in Wireless Communications	2%
	Lab	Unit 7 Lab 1: Hacking with the Help of Network Monitoring Tools	3%
	Quiz	Unit 7 Quiz 3	5%
	Project ePORTFOLIO	Project Part 1: Project Proposal Summary (Due) (ePORTFOLIO)	11.5%

Unit 8: SUPPORT FOR MOBILITY

Out-of-class work:
29 hrs.

Upon completion of this unit, students are expected to:

- Explain how the Wireless Datagram Protocol operates.
- Identify problems encountered by Web applications when used in a mobile environment.
- Describe the major components of a Wireless Application Environment (WAE).
- Demonstrate techniques for solving mobility problems above the Network Layer.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Schiller and Grayson Part 1, Chapter 10 • Schiller and Grayson Part 2, Chapter 6	Project ePORTFOLIO	Project Part 2: Wireless Project (Assigned) (ePORTFOLIO)	N/A

Unit 9: RFID

Out-of-class work:
14 hrs.

Upon completion of this unit, students are expected to:

- Describe the history of RFID.
- Describe the major components of RFID.
- Explain how RFID is currently being used.
- Describe the security concerns facing this technology.
- Identify the major market factors accelerating the use of RFID.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Miles, Chapters 1, 2, 8, and 12 From ITT Tech Virtual Library. See Required Resources section above for full reference and location.	Assignment	Unit 9 Assignment 1: Applications of RFID Systems in Industry	2%
	Lab	Unit 9 Lab 1: RFID Reader/Tag Test	3%
	Quiz	Unit 9 Quiz 4	5%

Unit 10: ZIGBEE WIRELESS

Out-of-class work: *2 hrs.*

Upon completion of this unit, students are expected to:

- Explain where ZigBee fits in the world of Bluetooth and 802.11 networks.
- Explain the history and evolution of ZigBee.
- Describe the ZigBee protocol stack.
- Describe the differences among all of the ZigBee profiles.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
• Cache, Chapter 11 From ITT Tech Virtual Library. See Required Resources section above for full reference and location.	Lab	Unit 10 Lab 1: ZigBee Functionality	3%

Unit 11: COURSE REVIEW, FINAL EXAMINATION, AND FINAL PROJECT PRESENTATIONS

Out-of-class work: *5 hrs.*

Upon completion of this unit, students are expected to:

- Demonstrate knowledge of wireless systems.
- Apply knowledge of wireless systems.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
None	Project ePORTFOLIO	Project Part 2: Wireless Project (Due) (ePORTFOLIO)	11.5%
	Exam	Final Exam	15%

Note: Your instructor may add a few learning activities that will change the grade allocation for each assignment in a category. The overall category percentages will not change.

Evaluation and Grading

Evaluation Criteria

The graded assignments will be evaluated using the following weighted categories:

Category	Weight
Assignment	18%
Lab	24%
Project	23%
Quiz	20%
Exam	15%
TOTAL	**100%**

Grade Conversion

The final grades will be calculated from the percentages earned in the course, as follows:

Grade	Percentage	Credit
A	90–100%	4.0
B+	85–89%	3.5
B	80–84%	3.0
C+	75–79%	2.5
C	70–74%	2.0
D+	65–69%	1.5
D	60–64%	1.0
F	<60%	0.0

Academic Integrity

All students must comply with the policies that regulate all forms of academic dishonesty, or academic misconduct, including plagiarism, self-plagiarism, fabrication, deception, cheating, and sabotage. For more information on the academic honesty policies, refer to the Student Handbook and the Course Catalog.

Out-of-Class Work

Unit Number	Title of Activity (for work completed OUTSIDE of class)	Type of Activity	Estimated Time of Activity (minutes)
1	Schiller and Grayson Part 1, Chapter 7 (225-255) Preparatory Reading	Reading	90
1	Wireless LAN Technologies	Homework	180
2	Schiller and Grayson Part 1, Chapter 7 (255-321) Preparatory Reading	Reading	190
2	Wireless LANs, 7.7 Review Questions	Homework	160
3	Schiller and Grayson Part 1, Chapter 4 Preparatory Reading	Reading	195
3	Schiller and Grayson Part 2, Chapter 8 Preparatory Reading	Reading	120
3	Schiller and Grayson Part 2, Chapter 5 Preparatory Reading	Reading	160
3	Quiz Prep	Quiz Prep	90
3	Wireless LANs - Review Questions	Homework	100
4	Schiller and Grayson Part 1, Chapter 9 Preparatory Reading	Reading	60
4	Review Questions	Homework	100
5	Rao & Radhamani, Chapters 1, 3, 5 Preparatory Reading	Reading	300
5	Quiz Prep	Quiz Prep	90
5	Wireless LANs - Complete 9 Research Questions	Research	120
6	Khan, Chapters 1 and 2, Preparatory Reading	Reading	120
6	Rao & Radhaman, Chapter 6, Preparatory Reading	Reading	160
6	Project Part 1 - Project Proposal Summary	Project	1000
7	Cache, Chapters 1, 2, 3, 4, 5, 8, and 9 Preparatory Reading	Reading	800
7	Quiz Prep	Quiz Prep	90
8	Schiller and Grayson Part 1, Chapter 10 Preparatory Reading	Reading	160
8	Schiller and Grayson Part 2, Chapter 6 Preparatory Reading	Reading	80
8	Project Part 2 - Wireless Project	Project	1500
9	Miles, Chapters 1, 2, 8, and 12 Preparatory Reading	Reading	300
9	Quiz Prep	Quiz Prep	90
9	Applications of RFID Systems in Industry	Homework	450
10	Cache, Chapter 11 Preparatory Reading	Reading	90
11	Final Exam Preparation	Exam	300
11	Project Presentation	Project	300

(End of Syllabus)