

MC2665

Mobile Communication Devices

[Onsite]

Course Description:

In this course, students study mobile communication devices (such as terminals, phones, etc.) from both hardware and software aspects. Topics of study include, but are not limited to, the evolution of mobile communication devices, mobile computers, personal digital assistant/enterprise digital assistant, graphic calculator, handheld game consoles, digital camera and camcorder, portable media player, e-book reader, mobile phone, pager, personal navigation devices (PNDs).

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

Prerequisite: MC2560 Mobile Wireless Communications I or equivalent

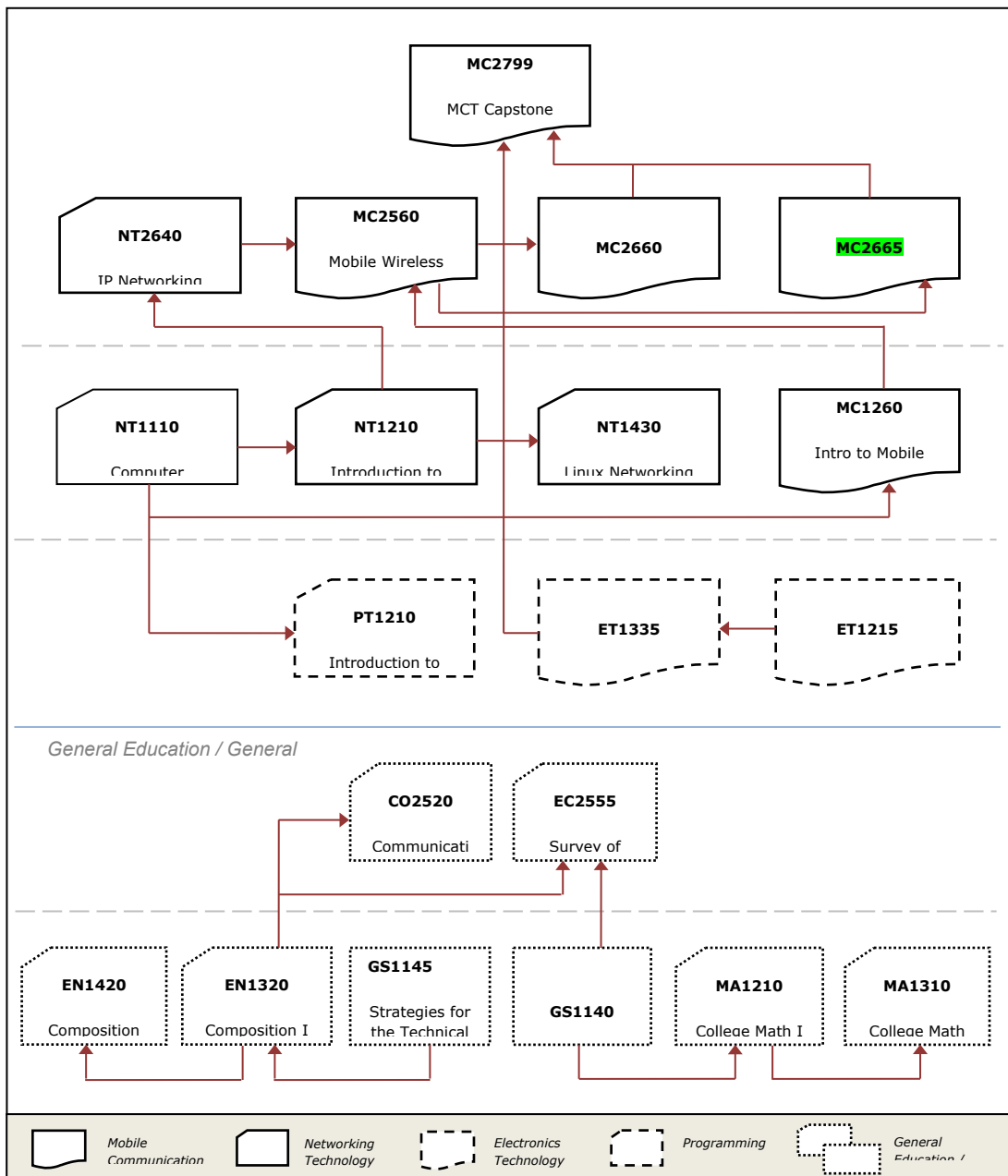
Credit hours: 4.5

Contact hours: 45 (45 Theory Hours)

Where Does This Course Belong?

This is a course of the Mobile Communications Technology program in the School of Information Technology.

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



NOTE: Refer to the catalog for the state-specific course and program information, if applicable.

Course Summary

Major Instructional Areas

- The evolution of mobile communication devices
- Mobile computers
- Personal digital assistant/enterprise digital assistant
- Graphic calculator
- Handheld game consoles
- Digital camera and camcorder
- Portable media player
- E-book reader
- Mobile phone pager
- Personal navigation devices (PNDs)

Course Objectives

1. Compare and contrast the main features of mobile communication devices from both hardware and software aspects.
2. Analyze industry standards and regulations on mobile communications and devices.
3. Recite historical content and the evolution of mobile communication devices, cellular networks, technologies, standards and services.
4. Operate, configure, and troubleshoot mobile communication devices including E-book reader, mobile phone pager and personal navigation devices (PNDs).

Learning Materials and References

Required Resources

Complete Textbook Package	New to this Course	Carried over from Previous Course(s)	Required for Subsequent Course(s)
Das, S. (2010). <i>Mobile handset design</i> . Hoboken: NJ: John Wiley and Sons, Inc.	■		■
Ballard, B. (2007) <i>Designing the mobile user experience</i> . NJ: John Wiley and Sons, Inc.	■		■

Recommended Resources

Professional Associations

- GSM Association includes the world’s mobile operators and companies in the broader mobile ecosystem, including handset makers, software companies, equipment providers, Internet companies, and media and entertainment organizations. <http://www.gsm.org/>
- IEEE Standards Association develops and advances standards for global technologies. <http://standards.ieee.org>
- 4G Americas *promotes the deployment and adoption of the 3GPP family of mobile broadband technologies in the Americas.* <http://www.4gamericas.org/>

The 3rd Generation Partnership Project (3GPP) unites [Six] telecommunications standards bodies, known as “Organizational Partners” and provides their members with a stable environment to produce the highly successful Reports and Specifications that define 3GPP technologies.

<http://www.3gpp.org/>

- ITU (International Telecommunication Union), headquartered in Geneva, Switzerland, is the United Nations' specialized agency for information and communication technologies.
<http://www.itu.int/en/Pages/default.aspx>

ITT Tech Virtual Library (accessed via Student Portal | <https://studentportal.itt-tech.edu>)

- ITT Tech Virtual Library > ProQuest
 - Research and markets adds report: Global system for mobile communications (GSM) - global strategic business report. (2009). *Wireless News*.
 - Global mobile communications system celebrates 20 years. (2011, Jul 04). *UzReport.Com*.
- ITT Tech Virtual Library > LexisNexis Academic
 - ADCs meet power amplifier wireless system challenge, Electronics Weekly, June 28th, 2006.

Other References

- Radio-Electronics.com provides resources for electronics engineers.
<http://www.radio-electronics.com/>
- Tech FAQ includes a blog, tutorials and software.
<http://www.tech-faq.com/>
- UMTS World provides news, resources, and job listings in the mobile technology industry.
<http://www.umtsworld.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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- Nyquist Theorem
- Nyquist Rate
- Bandwidth
- Channel Capacity
- Baud
- Bit Rate
- Shannon-Hartley Theorem
- Analog Mobile Phone Systems (AMPS)
- Time Division Multiple Access (TDMA)
- Code Division Multiple Access (CDMA)
- Digital Analog Mobile Phone Systems (D-AMPS)
- Enhanced Data Rates for GSM Evolution (EDGE)
- Global System for Mobile Communication (GSM)
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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
<ul style="list-style-type: none">▪ 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	<ul style="list-style-type: none">▪ 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

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components every day

Course Outline***Unit 1: Introduction to Mobile Devices******Out-of-class work:***

9 hours

Upon completion of this unit, students are expected to:

- Identify components of a mobile device in a telecommunications system
- Compare and contrast analog and digital signals
- Calculate the sampling rate necessary to reproduce a signal of a given frequency
- Calculate the theoretical capacity of a channel with known characteristics
- Explain bit rate, baud and channel capacity
- Classify mobile device standards, features, functions and performance characteristics
- Describe the technology associated with different mobile phone standards
- Explain the evolution of cellular standards through technologies and driving factors
- Compare and contrast wired and wireless communications systems
- Appraise the key phenomena associated with wireless signal propagation
- Calculate propagation loss in different environments
- Calculate link budgets from known parameters
- Describe the different types of interference in cellular systems
- Explain the types of noise faced by designers of wireless receivers and transmitters
- Identify the three different types of diversity solutions for transmission
- Identify the function and main architectural components of a rake receiver

<ul style="list-style-type: none"> • Describe the broad categories of techniques used in channel estimation • Identify the functional blocks of an adaptive equalizer • Evaluate common techniques used to mitigate wireless interference and to detect and correct errors 			
READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Das, Chapters 1–3	Exercise	Unit 1 Exercise 1: Investigate the IS-95 Specification	2.5%
		Unit 1 Exercise 2: Mobile Device Block Diagram	2.5%
		Unit 1 Exercise 3: Signal Attenuation Calculation	2.5%

Unit 2: The GSM Wireless Standard

Out-of-class work:

9 hours

Upon completion of this unit, students are expected to:

- Identify the components of an RF transceiver on a block diagram
- Compare and contrast the three methods of Tx-Rx separation (duplexer, diplexer, Tx-Rx switch)
- Compare and contrast the methods of RF down conversion (heterodyne, superheterodyne, direct conversion)
- Describe the main components of a linear and non-linear transmitter design
- Describe wireless channel multiple access techniques used in mobile phones
- Calculate the spectral efficiency for different technologies
- Analyze different CDMA technologies and signaling methods
- Describe the architectural elements and services of a typical GSM network
- Explain how features of GSM enable mobility in the network
- Calculate key GSM system parameters and functions

READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Das, Chapters 4–7	Assignment	Unit 2 Assignment 1: Wireless Communication Systems Investigation	2.5%
	Exercise	Unit 2 Exercise 1: GSM System Architecture I	2.5%
		Unit 2 Exercise 2: GSM System Architecture II	2.5%

Unit 3: GSM Phone Operations

Out-of-class work:

9 hours

Upon completion of this unit, students are expected to:

- Create a software architecture block diagram for a GSM phone
- Compare and contrast GSM operating system and applications software
- Describe the operation of common GSM smartphone features and applications
- Explain the steps required in key GSM Phone Operations (Initial Acquisition, Call Origination, Handoff)
- Identify hardware components of a GSM handset
- Describe functional specifications for GSM hardware components

READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Das, Chapters 8–10	Assignment	Unit 3 Assignment 1: Operating System Software	2.5%
		Unit 3 Assignment 2: Open Systems Architecture Model	2.5%
		Unit 3 Assignment 3: GSM Security	2.5%
	Quiz	Unit 3 Quiz 1	2.5%

Unit 4: 2.5 and 3G

Out-of-class work:

Upon completion of this unit, students are expected to:			7 hours
<ul style="list-style-type: none"> • Compare two types of data transport • Explain the overall architecture of GSM data services • Compare and contrast GPRS and EDGE services 			

READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Das, Chapter 11	Assignment	Unit 4 Assignment 1: GPRS Protocol	2.5%
		Unit 4 Assignment 2: GPRS vs. EDGE	2.5%
	Exercise	Unit 4 Exercise 1: Trace a GPRS Packet	2.5%

Unit 5: UMTS Wireless Standard			Out-of-class work: 7 hours
Upon completion of this unit, students are expected to:			
<ul style="list-style-type: none"> • Explain the overall high-level architecture of the 3G standard • Describe the key features and components of the 3G UMTS modem • Explain the roles of various worldwide standards bodies (e.g. 3GPP) 			

READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Das, Chapters 12–13	Exercise	Unit 5. Exercise 1: UMTS Channel Structure	2.5%
		Unit 5 Exercise 2: UMTS Evolution	2.5%
		Unit 5 Exercise 3: UMTS Technical Parameters	2.5%

Unit 6: UMTS Phone Operation

Out-of-class work:

7 hours

Upon completion of this unit, students are expected to:

- Explain the UMTS protocol architecture
- Create and explain a block diagram for a complete UMTS phone
- Identify and describe the operation of common UMTS smartphone features and applications

READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Das, Chapters 14–15	Assignment	Unit 6 Assignment 1: HSDPA vs. EDGE	2.5%
		Unit 6 Assignment 2. UMTS Block Diagram (PORTFOLIO)	2.5%
	Exercise	Unit 6 Exercise 1: Cellular System Security	2.5%
	Quiz	Unit 6 Quiz 2	2.5%

Unit 7: Introduction to Mobile User Interface (UI)

Out-of-class work:

9 hours

Upon completion of this unit, students are expected to:

- Explain the unique requirements and constraints of the mobile application environment
- Identify and describe the attributes of mobile device application users
- Provide an overall description of a personal communication device from an

applications perspective <ul style="list-style-type: none"> Compare and contrast static and mobile applications. 			
READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Ballard, Chapters 1–3	Assignment	Unit 7 Assignment 1: Mobile Application	2.5%
		Unit 7 Assignment 2: Groups & Tribes	2.5%
		Unit 7 Assignment 3: Mobile vs. Static Applications	2.5%
	Exercise	Unit 7 Exercise 1: Mobile Operating Systems	2.5%

Unit 8: Mobile UI Design Principles

Out-of-class work:

9 hours

Upon completion of this unit, students are expected to:

- Identify and describe the primary technologies supporting the U/I
- Describe the basic performance criteria and principles of U/I operation
- Identify the capabilities and constraints of audio and video in the mobile environment

READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Ballard, Chapters 4–6	Exercise	Unit 8 Exercise 1: Mobile Screen Design	2.5%
		Unit 8 Exercise 2: Audio and Video	2.5%
		Unit 8 Exercise 3: Industry Players	2.5%

Unit 9: Next Generation Mobile Phones

Out-of-class work:

9 hours

Upon completion of this unit, students are expected to:

- Describe the high-level architecture and operation of the LTE standard
- Explain the technological challenges of 4G mobile system design
- Describe the basic principles of cognitive radio

READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)

Das, Chapters 16 and 17	Assignment	Unit 9 Assignment 1: 3GPP LTE vs. WiMax	2.5%
		Unit 9 Assignment 2: Proliferation of 4G	2.5%
		Unit 9 Assignment 3: 802.16m	2.5%
	Quiz	Unit 9 Quiz 3	2.5%

<p>Unit 10: Competitive Mobile Phone Design</p> <p style="text-align: right;">Out-of-class work: 9 hours</p> <p>Upon completion of this unit, students are expected to:</p> <ul style="list-style-type: none"> Describe the important challenges of mobile design Identify and explain the phases associated with mobile development 			
READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Ballard, Chapters 9 and 10	Assignment	Unit 10 Assignment 1: Hardware/Software Partitioning (PORTFOLIO)	2.5%
		Unit 10 Assignment 2: Other Product Development Processes	2.5%
		Unit 10 Assignment 3: New Smart Phone Applications	2.5%

<p>Unit 11: Course Review and Final Exam</p> <p style="text-align: right;">Out-of-class work: 7 hours</p>			
READING ASSIGNMENT	GRADED ACTIVITIES/DELIVERABLES		

	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Review All Chapters	Exam	Final Examination	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	42.5%
Exercise	35%
Quiz	7.5%
Exam	15%
TOTAL	100%

Grade Conversion

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

Grade	Percentage	Credit
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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.

(End of Syllabus)