The course will provide students with a basic understanding of mobile computing and its applications, designing wireless network, and security issues in a mobile environment. Emphasis will be placed on acquiring the knowledge and skills required for planning, designing and securing wireless local area networks (WLAN) using available standards and technologies. The prerequisite for this course is IST 240 and junior status of IST. The course will cover the following topics:

- Networking basis
- Basics of mobile technologies.
- How does wireless work
- Potential applications of mobile technologies
- Wireless LAN design and management
- Wireless WAN design and management
- Mobile security issues and technologies

A major component of the course is the team-based term project. This course will incorporate collaborative and action-learning experiences wherever appropriate.

Course Objectives:

Upon completion of the course, the students will be able:

- To understand the basics of mobile technologies.
- To understand the potential applications of mobile technologies.
- To understand the theory behind mobile communications.
- To plan, design and implement mobile LAN and WANs.
- To select and apply mobile technologies for integration and applications
- To understand security issues and methodologies in a mobile environment.

Classes Information:

- Class Time: MW 1:15-2:30 PM (Friday the same time is also reserved for this class)
- Class Room/Lab: 202G Rider II

About the Instructor/TA:

- Instructor: Chao H. Chu
- Office: 2Q Thomas Bldg.
- Office Hours: MW 2:30-3:30 PM; TH: 10:00-11:00 AM or by appointment
- Phone/Fax: (814) 865-4446 / 865-6426
- E-mail: chu@ist.psu.edu
- Web Site: http://net1.ist.psu.edu/chu/
• **TA:** Tao Yang
• **Office:** 7B Thomas Bldg.
• **Office Hours:** F: 1:30-3:00 PM (in Lab); Tu: 10:00-11:00 AM (In office)
• **Phone:** (814) 865-6175
• **E-mail:** tyang@ist.psu.edu

**Textbooks:**

- Additional readings will be provided later.

**Course Policies:**

- One **CLOSED** book examination will be given. The examination will be given in class (to be announced).
- A term **project** is required for the course. Details of the project will be announced in class later.
- Question and class **participation** are encouraged and will be taken into consideration in the final grade.
- **Students with disabilities.** It is Penn State's policy to not discriminate against qualified students with documented disabilities. If you have a disability-related need for modifying your exam or test environment, notify your instructor during the first week of classes so that your needs can be accommodated. You will be asked to present documentation from the Office of Disability Services (located in 105 Boucke Building) that describes the nature of your disability and the recommended remedy. You may refer to the Nondiscrimination Policy in the Student Guide to University Policies and Rules.
- **Americans with Disabilities Act.** The School of Information Sciences and Technology (IST) welcomes persons with disabilities to all of its classes, programs, and events. If you need accommodations, or have questions about access to buildings where IST activities are held, please contact the Dean's Office (814) 865-3528 in advance of your participation or visit. If you need assistance during a class, program, or event, please contact any member of our staff or faculty in charge.
- **PSU Statement on Academic Integrity.** According to the University Advising Handbook: "Academic integrity is the pursuit of scholarly activity free from fraud and deception, and is the educational objective of this institution. Academic dishonesty includes, but is not limited to cheating, plagiarism, fabrication of information or citations, facilitating acts of academic dishonesty by others, unauthorized possession of examinations, submitting work of another person, or work previously used without informing the instructor, or tampering with the academic work of other students. Any violation of academic integrity will be thoroughly investigated, and where warranted, punitive action will be taken." Students should be aware that standards for documentation and intellectual contribution may depend on the course content and method of teaching, and should consult instructors for guidance.
Grading Weights:

Evaluation of knowledge and understanding of materials will be by examination, hands-on exercises, project, and class participation.

- Examination (Individual): 20%
- Hands-on exercises (Team): 30%
- Problems (Individual): 15%
- Class Participation (Individual): 10%
- Team Project: 25%

Selected Web Links:

Journals/Magazine/FAQ:


Mobile Security:

- Old Links (No Longer Maintained), [http://www.lava.net/~newsham/wlan/](http://www.lava.net/~newsham/wlan/)

Others:

- Broadbeam Corp., [www.broadbeam.com](http://www.broadbeam.com)
- Certicom, [www.certicom.com](http://www.certicom.com)

Detailed Contents:

The course will cover 12 modules. A tentative list of topics for each module is given below:

Module 1: Networking Fundamentals (Brief)

- Analog vs. digital data
- Data representation
- Open Systems Interconnectivity (OSI)
- Elements of networks (hardware & software)
Module 2: Basis of Wireless Communications
- What is mobile computing?
- The driving forces to wireless
- Advantages vs. disadvantages of wireless
- Key elements of wireless networks or systems
- Spectrum of mobile technologies – mobile phone 2/3/4 G; palm; pocket PC; tablet
- Potential applications of mobile computing
- Mobile challenges and limitations
- Determinants of successful applications.

Module 3: Overview of Mobile Technology
- Types of wireless transmission
- Basic components – filter, mixer, amplifier, antenna
- Infrared light transmission
- Radio frequency transmission – AM / FM / PM
- Factors impact radio transmission
- Bluetooth technology
- IEEE 802.11 a/b/g technology
- Comparison and selection of technology

Module 4: Comparison of Mobile Technologies
- Spread spectrum transmission
  - FHSS (Frequency Hopping Spread Spectrum)
  - DSSS (Direct Sequence Spread Spectrum)
- FDMA - Frequency Division Multiple Access
- TDMA – Time Division Multiple Access
- CDMA – Code Division Multiple Access
- Comparison of wireless technology – AMPS, TDMA, GSM, GPRS, UMTS, etc.

Module 5: Wireless Application Protocols (WAP) (Brief)
- Bearers – SMS, USSD, CSD, IS-136, CDMA, CDPD, PDC, etc.
- WPD – wireless datagram protocol
- WTLS – wireless transport layer security
- WTP – wireless session protocol
- WSP – Wireless session protocol
- WAE - Wireless Application environment
- Versions of WAP – WAP 1.1, WAP 1.2, WAP 2.0
- WAP network architecture
- MAC - Media Access Control
- LLC – Logical Link Control
• PHY – Physical Layer
• IrDA standards and protocol
• Bluetooth standards and protocol
• 802.11x standards and protocol

Module 6: Life Cycle of Wireless Network Design
• Life Cycle of Network Design – Planning, Analysis, Design, Implementation
• Planning – wireless strategic planning
• Planning – challenges, threats, and trends
• Analysis – current network / systems status (strengths and weaknesses)
• Analysis – market gap analysis
• Analysis – requirements analysis
• Analysis – costs / benefits analysis
• Implementation – project management
• Implementation – change management

Module 7: Peer to Peer (Ad Hoc) Network Design
• Type of wireless network
• P-P network topology
• IrDA network design and configuration
• Bluetooth network design and configuration
• 802.11x network design and configuration
• Comparison of P-P network
• Implementation related issues

Module 8: Infrastructure Network Design
• Mobile wave propagation
• Factors impact wave propagation
• Propagation models
• Site surveying techniques
• Optimal network design (number and location of AP)
• 802.11x network design and configuration
• Implementation related issues

Module 9: Wireless Wide Area Network Design (Brief)
• Design of mesh network
• Digital cellular telephony
• Mobile gateway
• Mobile bridge
• Fixed wireless
• VPN – virtual private network

Module 10: Security Fundamentals
• Characteristics of computer intrusion
• Types of security breaches
• Security goals and vulnerabilities
• Methods of defense
• Basic encryption and decryption
• Intrusion prevention and detection
• Database security
• Security assessment
• Incident handling
• Risk management
• Legal and ethical issues in security

Module 11: Wireless Security
• Security weakness of wireless
• Exploiting WEP
• War Driving
• MAC filtering
• Rogue access point
• Wireless security countermeasure

Module 12: Advanced Wireless Security
• WEP/WEP2 security analysis
• Wireless security auditing
• Wireless intrusion detection
• Wireless denial of services (DoS)
• Exploiting virtual private network (VPN)

Tentative Schedule:

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