

The University of Texas at Tyler
Department of Electrical Engineering

**Course: EENG-4350.031– Wireless Communications
Networks (Special Topic)**

Syllabus

Catalog Description:

Introduction to Wireless Communications and Networks: transmission fundamentals, LANs, MANs, WANs, switching, ATM, TCP/IP; Wireless Communications: antennas, propagation, signal encoding, spread spectrum, error control; Wireless Networking: satellite communications, cellular networks, analog, TDMA, CDMA, cordless systems, wireless local loop, mobile IP, WAP; Wireless LANS: infrared, microwave, IEEE 802.11, Bluetooth, IEEE 802.15

Prerequisites: EENG 4312, Co- MATH 3351

Credits: (3 hours lecture, 0 hours laboratory per week)

Text(s): Wireless Communication Networks and Systems, 1st Edition
Cory Beard William Stallings, 2016 Pearson, ISBN-10 No: 0133594173

Additional Material: Schaum's Outline of Mathematical Handbook of Formulas and Tables (Recommended)

Course Coordinator: Dr. Joseph Kamto

Topics Covered: (paragraph of topics separated by semicolons)

Wireless channel, Signal encoding techniques, OFDM, OFDMA, spread spectrum; Bluetooth, Cellular wireless network, multipath fading Theory; 4th generation and advance LTE

Evaluation Methods: (only items in dark print apply):

1. Examinations / Quizzes
2. Homework
3. Report / Paper
4. Computer Programming
5. Project / Model
6. Presentation
7. Course Participation

Course Learning Objectives¹: By the end of this course students will be able to:

1. Introduction/ Transmission Fundamentals [1]
2. Nyquist Formulation and concept of Shannon's capacity of transmission channel [1]
3. Type of communication network, LAN, WAN, MAN (circuit switching vs packet switching) [1]
4. OSI, Protocols and TCP/IP suite (OSI layers vs. TCP/IP layers) [1]
3. Overview wireless communication (spectrum, signal propagation, antenna, path loss, BER vs Eb/No, Calculation of fading in the mobile environment [4]
4. Digital signal encoding technique (BPSK, FSK, QPSK, MFSK [4]
5. Error rate and error correction [1]
6. Orthogonal frequency division multiplexing (OFDM), Analyze of different medium access (spread spectrum, frequency hopping spread spectrum, direct sequence spread spectrum, code division multiple access [1,4]

7. Explain Spread spectrum (DSSS, FHSS, CDMA)
8. Bluetooth, ZigBee, IEEE 802.15 [1]
12. Cellular wireless networks (call set up, handoff, WCDMA vs UMTS) [1]
13. 4th Generation systems and Long term evolution (FDD, TDD, LTE, carriers aggregation) [1]
14. Mobile applications and mobile IP [1]
15. Demonstrate knowledge of terminology, concepts, FCC rules to provide basis to communicate effectively with others in the technical community [1]
16. Find article from IEEE Spectrum, or other source that has relevance. Describe in short essay to describe this items [3]
17. Write short one page report on role and provide short description for a communications on the role impact of on the role and impact of engineering on Society based on instructor supplied article [3,6]

¹Numbers in brackets refer to method(s) used to evaluate the course objective.

Relationship to Program Outcomes (only items in dark print apply)²: This course supports the following Electrical Engineering Program Outcomes, which state that our students will:

1. have the ability to apply knowledge of the fundamentals of mathematics, science, and engineering;[3]
2. have the ability to use modern engineering tools and techniques in the practice of electrical engineering;[5]
3. have the ability to analyze electrical circuits, devices, and systems;[1, 6, 7, 8, 9, 10, 11, 12, 13, 14]
4. have the ability to design electrical circuits, devices, and systems to meet application requirements;[2, 4]
5. have the ability to design and conduct experiments, and analyze and interpret experimental results;
6. have the ability to identify, formulate, and solve problems in the practice of electrical engineering using appropriate theoretical and experimental methods;
7. have effective written, visual, and oral communication skills;
8. possess an educational background to understand the global context in which engineering is practiced, including:
 - a. knowledge of contemporary issues related to science and engineering;[16]
 - b. the impact of engineering on society;[17]
 - c. the role of ethics in the practice of engineering;
9. have the ability to contribute effectively as members of multi-disciplinary engineering teams;
10. have a recognition of the need for and ability to pursue continued learning throughout their professional careers.[15]

²Numbers in brackets refer to course objective(s) that address the Program Outcome.

Contribution to Meeting Professional Component: (in semester hours)

Mathematics and Basic Sciences:		hours
Engineering Sciences and Design:	3	hours
General Education Component:		hours

Prepared By: Joseph Kamto

Date: Jan 10, 2020

Modified By:

UNIVERSITY POLICIES AND ADDITIONAL INFORMATION THAT MUST APPEAR IN EACH COURSE SYLLABUS

UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link:

<http://www.uttyler.edu/wellness/rightsresponsibilities.php>

Campus Carry

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at: <http://www.uttyler.edu/about/campus-carry/index.php>

UT Tyler a Tobacco-Free University

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.

Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products.

There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support.

For more information on cessation programs please visit: www.uttyler.edu/tobacco-free.

Grade Replacement/Forgiveness and Census Date Policies

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement

Contracts are available in the Enrollment Services Center or at <http://www.uttyler.edu/registrar>. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a “W” grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university.

For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).

Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

Disability/Accessibility Services

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit: <https://hood.accessiblelearning.com/UTTyler> and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at <http://www.uttyler.edu/disabilityservices>, the SAR office located in the University Center, # 3150 or call 903.566.7079.

Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

Social Security and FERPA Statement

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

Emergency Exits and Evacuation

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit.

If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

Student Standards of Academic Conduct

Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

- i. "Cheating" includes, but is not limited to:
 - ✓ copying from another student's test paper;
 - ✓ using, during a test, materials not authorized by the person giving the test;
 - ✓ failure to comply with instructions given by the person administering the test;
 - ✓ possession during a test of materials which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes". The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
 - ✓ using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
 - ✓ collaborating with or seeking aid from another student during a test or other assignment without authority;
 - ✓ discussing the contents of an examination with another student who will take the examination;
 - ✓ divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
 - ✓ substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
 - ✓ paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
 - ✓ falsifying research data, laboratory reports, and/or other academic work offered for credit;
 - ✓ taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and misrepresenting facts, including providing false grades or

- resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.
- ii. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.
 - iii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.
 - iv. All written work that is submitted will be subject to review by plagiarism software.

UT Tyler Resources for Students

- ✓ UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu
- ✓ UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu
- ✓ The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- ✓ UT Tyler Counseling Center (903.566.7254)

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Outline

Grading Policy		30% Homework/class participation 20% Exam I /Exam II 20% Midterm Exam 20% Final Exam 10% Paper Review	
Week	Reading	Topic	Homework
Week1	Chp1-2	1.0 Week – Introduction/ Transmission Fundamentals Wireless Comes of Age, The Cellular Revolution, The Global Cellular Network, Broadband, Future Trends, The Trouble with Wireless, signal for conveying information, analog and digital transmission, channel capacity, transmission medium	
Week1	Chp3	2.0 Week – Communication Networks LANs, MANs, and WANs, Switching Techniques, Circuit Switching, Packet Switching, Quality of service, Asynchronous Transfer Mode	
Week2	Chp4	3.0 Week – Protocols and TCP/IP suite The Need for a Protocol Architecture, The TCP/IP Protocol Architecture, The OSI Model, Internetworking	HW1
Week2	Chp5	4.0 Week – Overview of wireless communication Spectrum, line of sight transmission, Fading in the mobile environment	
Week3	Chp5	5.0 Week – wireless channel Antennas. Propagation Modes, Line-of-Sight Transmission, Fading in the Mobile Environment , channel correction, digital signal encoding, OFDM, spread spectrum	HW2 EX1
Week4-5	Chp7	6.0 Week – Signal Encoding Techniques Signal Encoding Criteria, Digital Data-Analog Signals, Analog Data-Analog Signals, Analog Data-Digital Signals	WH3
Week5-6	Chp8	7.0 Week – orthogonal frequency division multiplexing, Concept of orthogonal frequency division multiplexing, orthogonal frequency division multiple access (OFDMA), single carrier FDMA	WH4
Week7		8.0 Week – Midterm Exam	MT
Week8	Chp9	9.0 Week – spread spectrum Concept of spread spectrum, frequency hopping spread spectrum, direct sequence spread spectrum, code division multiple access	

Week 9		10.0 Spring break	
Week10	Chp10	11.0 Week – coding and error control Error detection, block error correction codes, convolution codes, automatic repeat request,	
Week11	Chp11	12.0 Week – wireless lan technology Overview and motivation, 802 architectures, 802.11 architecture and services and medium access control and physical layer, wifi,	HW5
Week12	Week12	13.0 Week – Bluetooth and iee 802.15 Internet of thing, motivation and overview, specification, iee 802.15, ZigBee,	
Week13	Chp13	Week – Exam2	EX2
Week14	Chp14	14.0 Week – cellular wireless network Principle of cellular network, first generation analog, second generation TDMA, second generation CDMA, third generation system	WH6
Week15	Chp15	15.0 Week – fourth generation systems and LTE-advanced Purpose, motivation and approach to 4G, LTE architecture, evolved packet core, resource management, channel structure and protocol, radio access network. LTE advanced	
		16.0 Week – mobile applications and mobile IP	
		17.0 Final exam	FE