Instructor: Dr. Riki Y. Morikawa  
E-mail: rmorika2@gmu.edu  
Office Hours: Wednesday, 1 to 3PM (or by appointment)  
Office Location: Science and Technology Campus (STC), BRH 102C

Catalog Description  
This course covers fundamental principles underlying wireless data communications. Topics include wireless transmission basics, radio propagation issues, antennas, digital modulation, spread spectrum techniques and their applications, and popular standards: WiFi, WiMAX and Bluetooth. This course also presents practical knowledge to enable the design, testing, deployment, debugging and commissioning of WiFi, WiMAX networks and point-to-point microwave systems. Discussions on cellular network technologies are also included.

Course Objectives  
Students will gain literacy in the understanding the fundamentals of wireless communications and network systems. The course has three objectives:

- To explain theoretical foundations underlying wireless technologies.
- To gain an understanding of the fundamental laws and theories that govern wireless communications and networking.
- To introduce cutting-edge wireless communications systems and trends such as those in the areas of modern cellular and satellite communications systems.

Rationale  
Wireless communications and networking has become an integral part of our daily routines driven by our need for mobile data communications. Wireless enables a wide spectrum of services including voice and data communications, navigation, entertainment, telemetry and ecommerce. This course provides a sound foundation on the theoretical principles behind these technologies and discusses up-to-date issues surrounding them. Concepts learned in prerequisite courses are applied and extended in this class.

Course Outcomes  
- Students will review their understanding of basic information technology principles learned in the prerequisite courses. Review concepts include basic sinusoidal signal parameters (frequency, wavelength, bandwidth), networking basics (LAN, WAN, protocols such as TCP/IP, OSI Reference Model), and data communications and equipment (error performance, repeaters, multiplexers, codecs, modems).
- Building upon these concepts, students advance their understanding of the basic foundations of wireless communications and how these concepts are applied to modern wireless systems used today. These concepts include:
  - Complex modulation schemes and its effect upon error control and signaling power strength.
  - Concepts such as Shannon-Hartley, Hartley's Law, Friis free space loss equations, error control schemes, modulation schemes employing M-ary symbol representations, impact of thermal noise and other error introducing phenomena.
  - Applications of wireless concepts such as cellular 4G (and beyond) standards, Wi-Fi, WiMAX, LTE, Satellite Systems etc.
- Trends in wireless networking will also be revealed. Students will gain basic literacy in understanding the regulatory issues surrounding wireless telecommunication systems.
- Through the submission of the individual research paper, students will be able to gain literacy in a wireless technology of their choice as well as practice in research and writing skills.
Prerequisites
(IT 101 or IT 105) and (IT 102 or MATH 112 or MATH 125) and IT 341. Prerequisite enforced by registration system.

Required Textbook
Wireless Communication Networks and Systems, Cory Beard and William Stallings
Pearson Higher Education Inc., Hoboken, NJ 07030, Copyright 2016

Religious Holidays
A list of religious holidays is available on the University Life Calendar web page. Any student whose religious observance conflicts with a scheduled course activity must contact the Instructor at least 2 weeks in advance of the conflict date in order to make alternative arrangements.

Privacy
Instructors respect and protect the privacy of information related to individual students. Issues relating to an individual student will be discussed via email, telephone or in person. Instructors will not discuss issues relating to an individual student with other students (or anyone without a need to know) without prior permission of the student. Faculty and staff will take care to protect the privacy of each student's scores and grades.

Disability Accommodation
The Office of Disability Services (ODS) works with disabled students to arrange for appropriate accommodations to ensure equal access to university services. Any student with a disability of any kind is strongly encouraged to register with ODS as soon as possible and take advantage of the services offered.

Accommodations for disabled students must be made in advance – ODS cannot assist students retroactively, and at least one week's notice is required for special accommodations related to exams. Any student who needs accommodation should contact the Instructor during the first week of the semester so the sufficient time is allowed to make arrangements. The accommodations provided will be limited only to those specified on the ODS form.

Mason Diversity Statement
George Mason University is fully committed to diversity. Further information on the University’s statement regarding this matter may be found from the following link: http://ctfe.gmu.edu/professional-development/mason-diversity-statement/

Honor Code
All members of the Mason community are expected to uphold the principles of scholarly ethics. On admission to Mason, students agree to comply with the requirements of the GMU Honor System and Code (see http://oai.gmu.edu/).

The Honor Code will be strictly enforced in this course!

Any use of the words or ideas of another person(s), without explicit attribution that clearly identifies the material used and its source in an appropriate manner, is plagiarism and will not be tolerated. All student written work will be submitted via plagiarism tools such as SafeAssign.

Communication
Registered students will be given access to a section of the Blackboard Learning System for this course. Blackboard will be used as the primary mechanism to disseminate course information, lecture slides and materials, quizzes, lab projects, and homework.

Communication with the Instructor on issues relating to the individual student should be conducted using GMU email, telephone, or in person meeting; ...not in public forums on Blackboard.
Grading
Grades will be awarded in accordance with the GMU Grading System for undergraduate students. Raw scores may be adjusted by the Instructor to calculate final grades.

The grading scale for this course is:

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Grade</th>
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<tbody>
<tr>
<td>97 – 100%</td>
<td>A+</td>
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<tr>
<td>93 – 96%</td>
<td>A</td>
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<tr>
<td>90 – 92%</td>
<td>A-</td>
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<tr>
<td>87 – 89%</td>
<td>B+</td>
</tr>
<tr>
<td>83 – 86%</td>
<td>B</td>
</tr>
<tr>
<td>80 – 82%</td>
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<tr>
<td>77 – 79%</td>
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<td>60 – 69%</td>
<td>D</td>
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<tr>
<td>0 – 59%</td>
<td>F</td>
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Grade Distribution

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm Exam</td>
<td>30%</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
</tr>
<tr>
<td>Homework (6)</td>
<td>30%</td>
</tr>
<tr>
<td>Research Article (1)</td>
<td>10%</td>
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Examinations
The Midterm and Final Exams will be given online through the Bb course site (i.e., Assessments folder). Therefore, students will be required to download the Respondus LockDown browser and monitor application onto their PCs, which is available on Bb free of charge to GMU students. Students wishing to take the exam on paper vice online, can do so with prior notification to the instructor. If the paper exam is requested, the student will need to bring a SCANTRON form (Form No. 882-E) and a pencil.

All exams will be closed notes, closed book, and will consist of multiple choice questions that will require problem solving and a solid understanding of course materials. Calculators are required for all exams. Students must bring proper photo identification (Student ID, Drivers license, etc.).

The final exam will be held during the scheduled final exam period posted on the GMU Registrar's website:
http://registrar.gmu.edu/calendars/

Make-up exams will only be given to students with highly legitimate excuses such as a documented medical issue, family emergency, or exam conflict with another GMU course. Makeup exams will typically be given in the paper format. You must contact the instructor well in advance of the exam date if possible (i.e., typically more than two weeks prior). Date/time conflicts with a job are not acceptable excuses.

Homework
There will be six homework assignments with strict due dates enforced. The homework assignment will be posted on Blackboard approximately one week in advance of the due date. Students will submit completed assignments on Bb.

Research Article
Each student will select a current wireless topic and submit a three to five page analysis of the topic based upon a minimum of three articles published from authoritative sources. The objective is to quickly research a topic, obtain relevant background, conduct analysis and formulate an opinion. Being able to quickly form an opinion or recommendation based upon sound research is a necessary skill for an IT professional.
## Lecture Topics & Sessions (Fall 2017, IT 455 DL1):

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Content</th>
<th>Reading and Assignments</th>
</tr>
</thead>
</table>
| 1    | 8/30 | ● Course Overview  
● Ch1 - Introduction  
**Supplemental Material:**  
• Tech Notes & Videos on: Signal Representation, Decibels | ● Chapter 1 |
| 2    | 9/6  | ● Ch2 - Transmission Fundamentals Part 1  
**Supplemental Material:**  
• Tech Note on: Baud Versus Bit Rate (Hartley's Law) | ● Chapter 2 (Part 1) |
| 3    | 9/13 | ● Ch2 - Transmission Fundamentals Part 2  
**Supplemental Material:**  
• Tech Note on: Signal to Noise Ratio | ● Chapter 2 (Part 2)  
● HW#1 ch1 &2 (due 9/17) |
| 4    | 9/20 | ● Ch3 - Communication Networks  
**Supplemental Material:**  
• Thermal Noise, Shannon-Hartley Equation | ● Chapter 3 |
| 5    | 9/27 | ● Ch5 - Overview of Wireless Communication (Part 1)  
**Supplemental Material:**  
• Free-Space-Loss (Friis equation) | ● Chapter 5 (Part 1) |
| 6    | 10/4 | ● Ch5 - Overview of Wireless Communication (Part 2) | ● Chapter 5 (Part 2)  
● HW#2 ch 3, 5 & supp mat'l (due 10/8) |
| 7    | 10/11| ● Ch 4 - Protocols and the TCP/IP Suite | ● Chapter 4  
● HW#3 ch 4 (due 10/15) |
| 8    | 10/18| ● **Midterm Exam** - Online using Respondus LockDown Browser | ● Ch 1 through 5, supplemental materials on Bb |
| 9    | 10/25| ● Ch11 - Wireless LAN Technology | ● Chapter 11 |
| 10   | 11/1 | ● Ch12 - Bluetooth and IEEE 802.15 | ● Chapter 12  
● HW#4 ch 11 to 12 (due 11/5) |
| 11   | 11/8 | ● Ch13 - Cellular Wireless Networks | ● Chapter 13 |
| 12   | 11/15| ● Ch14 - Fourth Generation Systems and LTE-Advanced | ● Chapter 14  
● HW#5 ch13 to 14 (due 11/19) |
| 13   | 11/29| ● Ch15 - Mobile Applications and Mobile IP | ● Chapter 15  
● Research Article (due 12/3) |
| 14   | 12/6 | ● Ch16 - Long Range Communications  
● Review for Final | ● Chapter 16  
● HW#6 ch15 to 16 (due 12/10) |
| 15   | 12/13| ● **Final Exam** - Online using Respondus LockDown Browser | ● Cumulative |