Sample Syllabus: Cybersecurity Fundamentals

Instructor:	Dr. Ebuka Philip Oguchi
Course Number:	CS 3XX
Office:	To Be Determined
Office Hours:	To Be Determined

Course Description

This course provides a broad introduction to security, covering the security mindset, common threats, vulnerabilities, and countermeasures. We will explore cryptographic building blocks for message and user authentication, confidentiality, and integrity. We will then apply these concepts to real-world security in software, web applications, networks, and wireless systems. The course will include hands-on projects to provide practical experience with cybersecurity principles.

Course Objectives

Upon the completion of this course, students should have achieved the following objectives:

- Develop a "security mindset" for analyzing systems.
- Understand the objectives of cryptography and be able to apply suitable primitives to achieve specific security goals.
- Identify common software and web vulnerabilities (e.g., buffer overflows, SQL injection, XSS) and their countermeasures.
- Understand principles of access control, authentication, and network-level security (firewalls, IDS, SSL/TLS).
- Be able to evaluate the security of communication systems and protocols.
- Understand the legal and ethical issues surrounding cybersecurity and privacy.

Grading Policy

- Course Projects: 40%
- Homework Assignments: 30%
- Midterm Examination: 25%
- Class Participation: 5%

Course Projects

We will have three course projects designed to provide hands-on experience.

Project 1 - Crack Ciphers: Students will develop code to perform an automated ciphertext-only attack. The attack will involve 1) recognizing the encryption scheme, 2) cracking the key, and 3) outputting the corresponding plaintext.

Project 2 - Crack WEP: Students will learn about the vulnerabilities of the WEP security standard and use security tools to crack the key of a sample Wi-Fi access point provided for the lab.

Project 3 - Crack WPA: Students will extend their knowledge from the second project to crack the password of the WPA security standard for Wi-Fi, learning about its vulnerabilities.

Required Text

Cryptography and Network Security: Principles and Practice by William Stallings. (A recent edition is recommended).

Additional selected readings or articles may be provided by the instructor.

Course Topics

(Tentative 15-Week Schedule)

- **Week 1:** Introduction to Security (The Security Mindset, Threats, Vulnerabilities)
- **Week 2-3:** Symmetric Key Cryptography (Classical Ciphers, DES, AES, Modes of Operation)
- **Week 4-5:** Public Key Cryptography (RSA, Diffie-Hellman, ElGamal)
- **Week 6:** Message Integrity (Hash Functions, MACs) & Digital Signatures
- **Week 7:** User Authentication (Passwords, 2FA, Challenge-Response)
- **Week 8:** Software Security (Malware, Worms, Buffer Overflows, SQL Injection)

- **Week 9:** Web Security (Browser Model, XSS, CSRF)
- **Week 10:** Midterm Examination / Project 1 Due
- **Week 11:** Access Control (Policies, Models, ACLs, RBAC)
- **Week 12:** System & Network Security (Firewalls, VPNs, IDS/IPS, SSL/TLS)
- **Week 13:** Wireless Security (WEP/WPA vulnerabilities, 802.11i)
- **Week 14:** Modern Topics (IoT Security, Post-Quantum Cryptography)
- **Week 15:** Privacy, Legal, Ethical Issues & Final Review

Inclusive Learning Environment

This course is intended for all students, regardless of their background. I am committed to creating an inclusive and supportive classroom environment where every student feels respected and has the opportunity to succeed. I encourage you to speak with me about any barriers to your learning so we can discuss options.

Course Policies

Academic Integrity: Students are expected to adhere to the highest standards of academic honesty. All work submitted must be your own. While discussion of concepts is encouraged, all graded assignments and projects must be completed individually unless explicitly stated otherwise. Any use of external sources must be properly cited.

Late Work Policy: Deadlines are critical in this course. Late homework will be accepted with a penalty of 10% per day. Assignments will not be accepted more than 3 days late. Projects have firm deadlines and will not be accepted late, as solutions will be discussed in class.

Accommodations for Students with Disabilities: I am committed to providing an accessible learning experience. If you anticipate or experience barriers based on a disability, please schedule a meeting with me to discuss your needs. Students are encouraged to register with the university's Office of Disability Services (ODS) to establish reasonable accommodations.