

Course Outline

1. Document Information

Degree Program	Computer Science
Course Number	CS 408
Course Title	Applied Cryptography
Semester Hours	3
Course Coordinator	Bidyut Gupta
Revision Term	Fall 2020
Latest Revision	Fall 2020

2. Catalog Description

This course is a comprehensive introduction to modern cryptography, with an emphasis on the application and implementation of various techniques for achieving message confidentiality, integrity, authentication and non-repudiation. Applications to Internet security and electronic commerce will be discussed. All background mathematics will be covered in the course.

3. Textbooks

- Stallings, William. (2017). Cryptography & Network Security. Pearson, 7th Edition. ISBN:780134444284.

4. References

5. Course Learning Outcomes

- To understand the design principles of modern cryptographic algorithms.
- To learn a variety of cryptanalytic and side-channel attacks.
- To understand how cryptography is deployed in practice, with an emphasis on its application in network security.
- To learn how to implement cryptographic algorithms with symbolic computation software.

6. Assessment of the Contribution to Student Outcomes

Outcome	1	2	3	4	5	6	7
Assessed	X	X	X	X	X	X	

7. Prerequisites by Topic

CS 330 with a grade of C or better and MATH 221 or graduate standing.

8. Major Topics Covered in the Course

1. Symmetric-key encryption: classical ciphers, one-time pad, stream ciphers (RC4), Feistel networks, DES, AES, modes of operation {8 classes}
2. Message integrity: hash functions, Merkle's Meta method, parallel collision search, message authentication codes (CBC-MAC, HMAC) {5 classes}
3. Key escrow and secret sharing {2 classes}
4. Public-key encryption: RSA, ElGamal, padding schemes, semantic security {9 classes}
5. Signature schemes: RSA, DSA, ECDSA {3 classes}
6. Pseudorandom bit generation: random bit generation, cryptographically strong pseudorandom bit generators, Yao's Theorem {2 classes}
7. Key establishment and management: key distribution centers, Diffie-Hellman and station-to-station key agreement, Merkle authentication trees, certificate authorities, public key infrastructures {3 classes}
8. Deployed cryptography: Kerberos, PGP, SSL/TLS, WEP/WPA, digital payment systems (SET, ecash, micropayments), electronic voting {6 classes}
9. Selected advanced topics: zero-knowledge proofs, strong password protocols (EKE/STP), identitybased encryption, broadcast encryption, oblivious transfer {2 classes}

NOTE: When course is taken as 500-level credit (CS 591 "Special Topics"), there will be additional requirements such as a research project.