

**ITT Technical Institute**

**IS3440T**

**Linux Security**

**Onsite Course**

# **SYLLABUS**

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**Credit hours:** 4.5

**Contact/Instructional hours:** 72 (36 Theory Hours, 36 Lab Hours)

**Prerequisite(s) and/or Corequisite(s):**

Prerequisites: NT1430T Linux Networking or equivalent

**Course Description:**

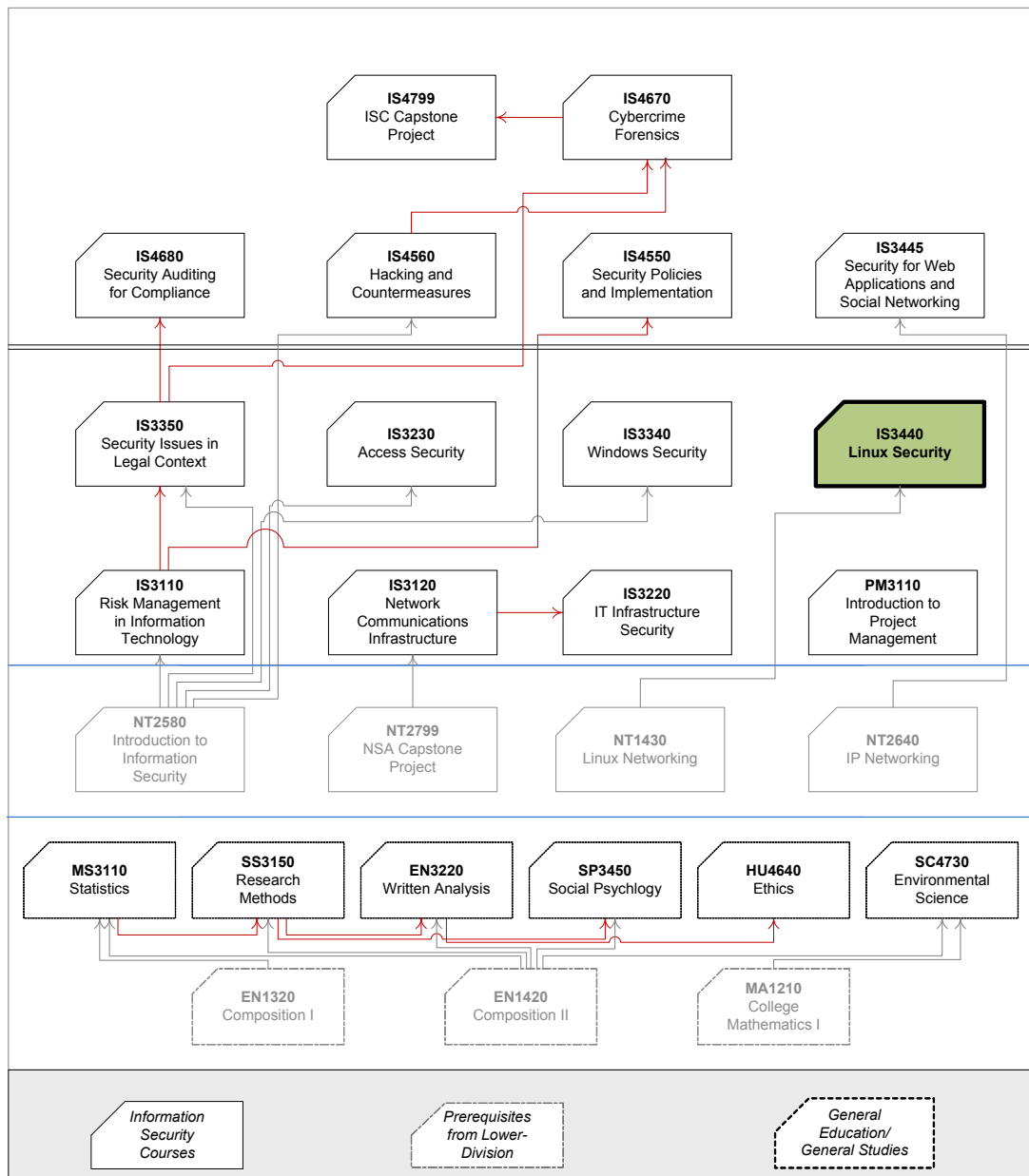
This course examines threats, vulnerabilities and other security issues in Linux operating systems and applications in the Linux environment. Students will practice using different methods, tools and techniques to secure Linux operating systems and applications.

## Where Does This Course Belong?

This course is required for the Bachelor of Science in Information Systems Security program. This program covers the following core areas:

- Foundational Courses
- Technical Courses
- BSISS Project

The following diagram demonstrates how this course fits in the program:



# Course Summary

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## Major Instructional Areas

1. Threats to Linux operating systems and other open source applications and mitigation of risks
2. Core components to secure Linux platform
3. User account management and software management plan
4. Network applications security
5. Linux kernel and techniques
6. Security breach response and recovery

## Course Objectives

1. Identify threats to the Linux operating system and other open source applications.
2. Configure the basic settings to secure a Linux platform.
3. Explain user account management and the principle of least privilege to protect and secure the system and its data.
4. Examine the flexibility of various options with file permissions and filesystem settings and how granular control isolates data access.
5. Describe security solutions to mitigate vulnerabilities in Linux services and the appropriate steps to mitigate the risks.
6. Assess how firewall, Transmission Control Protocol (TCP) Wrappers, and Security Enhanced Linux (SELinux) complement one another to secure network applications.
7. Assess the architecture of the Linux kernel and techniques used to enact a more secure kernel.
8. Evaluate the importance of maintaining a software management plan.
9. Establish a system baseline with monitoring and logging to detect anomalies.
10. Analyze the best practices to respond and recover from a security breach (incident).

## Learning Materials and References

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### Required Resources

Textbook Package	New to this Course	Carried over from Previous Course(s)	Required for Subsequent Course(s)
Jang, Michael. <i>Security Strategies in Linux Platforms and Applications</i> . 1 <sup>st</sup> ed. Sudbury, MA: Jones & Bartlett, 2011.	▪		
Printed IS3440 Student Lab Manual	▪		
ISS Mock IT Infrastructure (1) – Cisco Core Backbone Network consisting of Cisco 2811 routers, 2950/2960 catalyst switches, ASA 5505s for classroom equipment-based labs that require a live, IP network. (For onsite only)	▪	▪	▪
ISS Mock IT Infrastructure (2) – VM Server Farm (2 Microsoft Windows Servers and 2 Ubuntu Linux Servers) for classroom equipment-based VM labs. (For both onsite and online)	▪	▪	▪
ISS Mock IT Infrastructure (2) – VM Workstation (Microsoft Windows XP Professional Workstation with Core ISS Apps and Tools) for classroom equipment-based VM labs. (For both onsite and online)	▪	▪	▪

(1) The following presents the core ISS Cisco core backbone network components needed for some of the equipment-based labs for onsite delivery only. (Note: video labs will be used for online delivery):

- Cisco 2811 Routers
- Cisco 2950/2960 Catalyst Switches
- Cisco ASA 5505 Security Appliances
- Simulated WAN Infrastructure
- EGP using BGP4 or IGP using EIGRP
- Layer 2 Switching with VLAN Configurations
- Telnet and SSH version 2 for Remote Access
- Inside and Outside VLANs
- DMZ VLAN

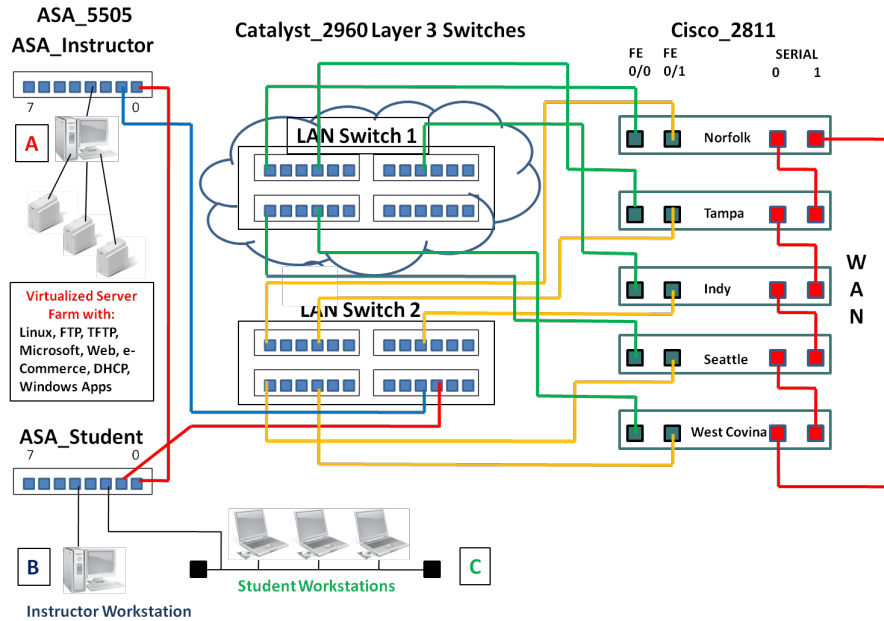


Figure 1 – ISS Cisco Core Backbone Network

- (2) The following lists the core ISS VM server farm and VM workstation OS, applications, and tools required for this course for both onsite and online course deliveries:

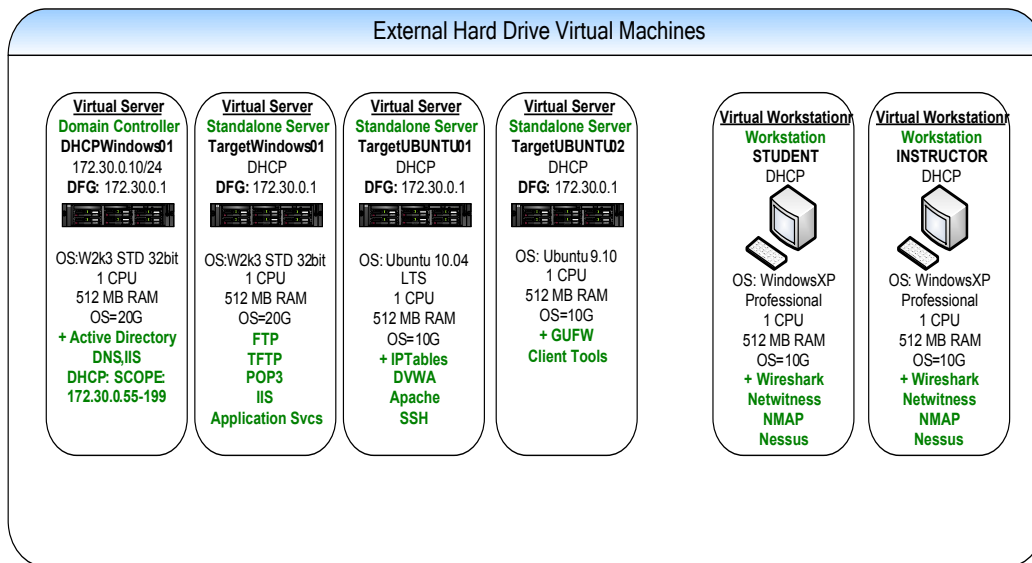


Figure 2 – ISS Core VM Server Farm & VM Workstations

**Note #1:** ISS onsite students can obtain their removable hard drive directly from their ITT campus. ISS online students will be required to download the core ISS VM server farm and VM workstations directly to their personal computer for installation. The ITT Onsite or Online Instructor will provide students with the specific instructions and procedures for how to obtain the core ISS VM server farm and workstation image files during the first week of class.

(3) The following lists the new VMs, applications, and tools required to perform the equipment-based labs for this course for both onsite and online deliveries:

1. New VM for server farm: "VulnerableXP01". This VM is a vulnerable Microsoft Windows Server 2003 Standard Edition used for performing attacks.
2. New VM for server farm: "Backtrack01". A Backtrack 4 Ubuntu Server pre-loaded with the following applications and tools:
  - a. Metasploit with required plug-ins
  - b. Kismet
  - c. Aircrack-ng
  - d. Aircsnort
  - e. Snort
  - f. MySQL
  - g. BASE
3. New VM that Replaces the Old "TargetUbuntu01" VM on the VM server farm. An Ubuntu Server 10.4 VM pre-loaded with the following applications and tools:
  - a. Damn Vulnerable Web App (DVWA)
  - b. ClamAV Installed
  - c. Rootkit Hunter: [http://www.rootkit.nl/projects/rootkit\\_hunter.html](http://www.rootkit.nl/projects/rootkit_hunter.html)
  - d. Chrootkit: <http://www.chkrootkit.org/>
  - e. Appropriate rootkit tools can be found at:  
<http://www.packetstormsecurity.org/UNIX/penetration/rootkits/indexdate.html>
  - f. Infected with EICAR
  - g. tcpdump
  - h. Common Linux tools such as strings, sed and grep
4. Tools Directory: A directory called "tools" which contains the binary installation files for each tool covered in the course, including:
  - a. Infected with EICAR
  - b. ClamAV Installed
  - c. Rootkit Hunter: [http://www.rootkit.nl/projects/rootkit\\_hunter.html](http://www.rootkit.nl/projects/rootkit_hunter.html)
  - d. Chrootkit: <http://www.chkrootkit.org/>
  - e. Appropriate rootkit tools can be found at:  
<http://www.packetstormsecurity.org/UNIX/penetration/rootkits/indexdate.html>
  - f. Wireshark
  - g. NetWitness Investigator
  - h. FileZilla FTP client/Server
  - i. Putty SSH client
  - j. Nessus<sup>®1</sup>

<sup>1</sup> Nessus<sup>®</sup> is a Registered Trademark of Tenable Network Security, Inc.

- k. Zenmap
- l. MD5sum
- m. SHA1sum
- n. GnuPG (Gnu Privacy Guard)
- o. OpenSSL
- p. VMware Player

**Note #2:** Installation instructions for installing these new VMs, applications and tools will be provided by the ISS onsite or online Instructor during day 1/ week 1 of the course.

## Recommended Resources

### Books, Professional Journals

Please use the following author's names, book/article titles and/or keywords to search in the ITT Tech Virtual Library for supplementary information to augment your learning in this subject:

Books

Books24X7

Ebrary

NetLibrary

Periodicals

EbscoHost

ACM Digital Library

Bill Childers

"Virtualization Shootout: VMware server vs. VirtualBox vs. KVM", *Linux Journal*, Nov2009, Vol. 2009 Issue 187

Brian Hatch, et al

*Hacking Exposed Linux*, 3<sup>rd</sup> ed. (Chapters 2, 13 and Appendix B)

Christian B. Lahti, et al

*Sarbanes-Oxley IT Compliance Using COBIT and Open Source Tools* (Chapters 3 and 4)

Craig Hunt

*Linux Network Servers: Craig Hunt Linux Library* (Chapters 3, 6 and 9)

Ellick M. Chan, et al

“BootJacker: compromising computers using forced restarts”, *Proceedings of the 15th ACM conference on Computer and communications security*, 2008, (Pages 555-564)

James Stanger, et al

*Hack Proofing Linux: A Guide to Open Source Security* (Chapter 2)

Jeramiah Bowling

“The tao of Linux security: five lessons for a secure deployment”, *Linux Journal*, Jan2008, Vol. 2008 Issue 165

Kyle Rankin

“Hack and /: Linux troubleshooting, Part I: high load”, *Linux Journal*, Mar2010, Vol. 2010 Issue 191

Kyle Rankin

“Introduction to forensics”, *Linux Journal*, Jan2008, Vol. 2008 Issue 165

Marco Fioretti

“How to setup and use tripwire”, *Linux Journal*, Jun2006, Vol. 2006 Issue 146, (Page 6)

Mick Bauer

“Paranoid penguin: brutally practical Linux desktop security”, *Linux Journal*, Oct2009, Vol. 2009 Issue 186

Mick Bauer

“Paranoid penguin: secured remote desktop/application sessions”, *Linux Journal*, Sep2008, Vol. 2008 Issue 173

Moshe Bar

*Linux Internals* (Chapter 2)

Richard Petersen

*Linux: The Complete Reference*, 6<sup>th</sup> ed. (Chapters 10, 20 and 32)

Robb H. Tracy

*Linux+ Certification Study Guide* (Chapters 6 and 7)

Robert Love



*Linux Kernel Development*, 2<sup>nd</sup> ed. (Chapter 2)

Roderick Smith

*Degunking Linux* (Chapter 6)

Scott Andrew Maxwell

*Linux Core Kernel Commentary*, 2<sup>nd</sup> ed. (Chapters 3 and 11)

Shadab Siddiqui

*Linux Security* (Chapters 2, 3, 5, 12 and 13)

William C. Benton

"Kernel korner: Loadable kernel module exploits", *Linux Journal*, Sep2001, Vol. 2001 Issue 89, (Page 7)

### Professional Associations

- The Linux Foundation  
This Web site provides Linux-related unified resources and services that enable open source platforms to compete with closed platforms.  
<http://www.linuxfoundation.org/> (accessed June 1, 2010).
- Linux Professional Institute  
This Web site provides advocacy and assistance in professional use of Linux, open source, and free software.  
<http://www.lpi.org/> (accessed June 1, 2010).

### Other References

- Institute for Security and Open Methodologies (ISECOM)  
This Web site provides certification, training support, project support services, and practical methods on security and integrity.  
<http://www.isecom.org/osstmm/> (accessed June 1, 2010).
- Filesystem Hierarchy Standard  
This Web site serves as a reference for UNIX distribution developers, package developers, and system implementers.  
<http://www.pathname.com/fhs/> (accessed June 1, 2010).
- National Security Agency/Central Security Service (NSA/CSS)

This Web site provides guidance on information assurance, security solutions, and insights on risks, vulnerabilities, mitigations, and threats. It also provides information on cryptologic support.  
<http://www.nsa.gov/> (accessed June 1, 2010).

**NOTE:** All links are subject to change without prior notice.

**Keywords:**

Accounts and Account Policies

Backup Plan

Custom Kernel

Data Access

Discretionary Access Control (DAC)

Encryption

File Permissions

File System Hierarchy (FHS)

File System Settings

Granular Control

Iptables

Linux Kernel

Linux Operating Systems

Linux Platforms

Linux Security

Linux Techniques

Loadable Kernel Modules (LKM)

Mandatory Access Control (MAC)

Network Applications

Packet Forwarding

Principle of Least Privilege

Public-Facing Web Server

SELinux

Security Breach

Software Management Plan

User Account Management

Web and Database Server

## Course Plan

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### Instructional Methods

This course is designed to promote learner-centered activities and support the development of cognitive strategies and competencies necessary for effective task performance and critical problem solving. The course utilizes individual and group learning activities, performance-driven assignments, problem-based cases, projects, and discussions. These methods focus on building engaging learning experiences conducive to development of critical knowledge and skills that can be effectively applied in professional contexts.

### Suggested Learning Approach

In this course, you will be studying individually and within a group of your peers. As you work on the course deliverables, you are encouraged to share ideas with your peers and instructor, work collaboratively on projects and team assignments, raise critical questions, and provide constructive feedback.

Use the following advice to receive maximum learning benefits from your participation in this course:

DO	DON'T
<ul style="list-style-type: none"><li>▪ Do take a proactive learning approach</li><li>▪ Do share your thoughts on critical issues and potential problem solutions</li><li>▪ Do plan your course work in advance</li><li>▪ Do explore a variety of learning resources in addition to the textbook</li><li>▪ Do offer relevant examples from your experience</li><li>▪ Do make an effort to understand different points of view</li></ul>	<ul style="list-style-type: none"><li>▪ Don't assume there is only one correct answer to a question</li><li>▪ Don't be afraid to share your perspective on the issues analyzed in the course</li><li>▪ Don't be negative towards the points of view that are different from yours</li><li>▪ Don't underestimate the impact of collaboration on your learning</li><li>▪ Don't limit your course experience to reading the textbook</li></ul>

DO	DON'T
<ul style="list-style-type: none"> <li>Do connect concepts explored in this course to real-life professional situations and your own experiences</li> </ul>	<ul style="list-style-type: none"> <li>Don't postpone your work on the course deliverables – work on small assignment components every day</li> </ul>

### Course Outline

Unit #	Unit Title	Assigned Readings	Graded Activities			
			Grading Category	#	Activity Title	Grade Allocation (% of all graded work)
1	Introduction to Linux Security	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>Chapter 1</li> </ul>	Discussion	1.1	Securing a Linux System	2
			Lab	1.2	Install a Core Linux Operating System on a Server	2
2	Securing a Linux Platform—Core Components	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>Chapter 2</li> <li>Chapter 3</li> </ul>	Discussion	2.1	Identifying Layers of Access Control in Linux	2
			Lab	2.2	Configure Basic Security Controls on a Fedora Linux Server	2
3	User Account Management	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>Chapter 4</li> </ul>	Quiz	3.1	Quiz 1	3
			Lab	3.2	Apply Hardened User Account Management & Security Controls	2
4	Securing the Linux Filesystem	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>Chapter 5</li> </ul>	Discussion	4.1	Compromising an Online System	2

Unit #	Unit Title	Assigned Readings	Graded Activities			
			Grading Category	#	Activity Title	Grade Allocation (% of all graded work)
			Lab	4.2	Apply Hardened Linux File System Security Controls	2
			Project	4.3	Project Part1: Executive Summary†	8
5	Securing Common Linux Services	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>▪ Chapter 6</li> <li>▪ Chapter 8</li> <li>▪ Chapter 9</li> </ul>	Quiz	5.1	Quiz 2	3
			Lab	5.2	Apply Hardened Security for Linux Services & Applications	2
6	Using Layered Security for Access Control	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>▪ Chapter 7</li> </ul>	Discussion	6.1	Determining Firewall Rules	2
			Lab	6.2	Apply Hardened Security for Controlling Access	2
7	Securing the Linux Kernel	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>▪ Chapter 10</li> </ul>	Quiz	7.1	Quiz 3	3
			Lab	7.2	Apply Hardened Security for the Linux Kernel	2
			Project	7.3	Project Part 2: Executive Summary†	8

Unit #	Unit Title	Assigned Readings	Graded Activities			
			Grading Category	#	Activity Title	Grade Allocation
						(% of all graded work)
8	Software Management	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>Chapter 11</li> </ul>	Discussion	8.1	Using Community and Vendor Support for Managing Software	2
			Lab	8.2	Implement Best Practices for Secure Software Management	2
9	Linux System Logging and Monitoring	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>Chapter 12</li> <li>Chapter 13</li> </ul>	Quiz	9.1	Quiz 4	3
			Lab	9.2	Implement Best Practices for Security Logging & Monitoring	2
10	Incident Response and Recovery	<i>Security Strategies in Linux Platforms and Applications:</i> <ul style="list-style-type: none"> <li>Chapter 14</li> </ul>	Discussion	10.1	Creating a Backup Plan	2
			Lab	10.2	Define Linux OS & Application Backup & Recovery Procedures	2
			Project	10.3	Project Part 3: Executive Summary†	8
11	Course Review and Final Examination	N/A	Project	11.1	Project Part 4: Executive Summary of the Project†	8
			Exam	11.2	Final Exam	24

† Candidate for ePortfolio

## Evaluation and Grading

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### Evaluation Criteria

The graded assignments will be evaluated using the following weighted categories:

Category	Weight
Lab	20
Project	32
Discussion	12
Quiz	12
Exam	24
<b>TOTAL</b>	<b>100%</b>

### Grade Conversion

The final grades will be calculated from the percentages earned in the course, as follows:

Grade	Percentage	Credit
A	90–100%	4.0
B+	85–89%	3.5
B	80–84%	3.0
C+	75–79%	2.5
C	70–74%	2.0
D+	65–69%	1.5
D	60–64%	1.0
F	<60%	0.0

## Academic Integrity

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All students must comply with the policies that regulate all forms of academic dishonesty, or academic misconduct, including plagiarism, self-plagiarism, fabrication, deception, cheating, and sabotage. For more information on the academic honesty policies, refer to the Student Handbook.

(End of Syllabus)