Ira A. Fulton Schools of Engineering
Arizona State University

Course Syllabus - Fall B 2022

CSE 548: Advanced Computer Network Security

Contact Information

Instructor: Abdulhakim Sabur

Live Sessions: To decide on the best time for you, please go to this Doodle Poll and vote on the Live Events time. Once the time is selected the syllabus and course will be updated.

Teaching Assistant(s): Abdualrhman Almeajel

Virtual Office Hours: Wednesdays from 9-10 AM MST

Content Questions: Coursera Discussion Forum

Project or Assignment Questions: Coursera Discussion Forum

Slack Channel: Slack Direct Link
Note: You must join/access this workspace using your ASURITE credentials.

Content Issues: Course “Report an Issue” tool (clickable link on every content page)

Technical Support: Coursera Learner Help Center
Note: Please make sure you are logged in so that support personnel recognize you as an ASU learner.

General Support: mcsonline@asu.edu
Note: When sending an email about this class, please include the prefix "CSE 548" in the subject line of your message. Please use this email address for questions that are private in nature. If it is a question that would benefit your classmates, and is not private in nature, please post in Ed Discussion.

Course Description

Focusing on the areas of applied cryptography, system security, and the principles and practices of network security, this course explores the necessary tools, techniques, and concepts of network security for modern computer networks. The course's coverage of advanced network security includes both cutting-edge technologies and research topics, primarily at the MAC layer and above. The course not only provides students with exposure to burgeoning areas of network security but also hands-on experience using the tools essential for computer network and cybersecurity today and in the future.

Specific topics covered include:

- Public key and symmetric key based cryptography
- Access control models
- Network security policies
- Authentication protocols
- Secure protocol standards
- Public Key Infrastructure and its development trends
- Virtual Private Network and its restrictions
- Attack graphs and attack trees
- SDN/NFV based Security Solutions
- Cloud network security
- ML and AI for computer network security
- Moving target defense in computer networks

Technologies covered include:

- Python
- Html
- Virtual Box 5.0
- Apache Web Service

Learning Outcomes

Learners completing this course will be able to:

- Explain basic security terminologies, models, architectures and techniques.
- Apply proven methodologies to design secure networks that address enduring and emerging issues.

- Apply network security standards and cryptography algorithms.
- Document the process of designing and implementing secure networking systems.
- Build a secure networking system to counter given network attacks.
- Adhere to standards of computer security ethics.
- Manage a network security establishment effort.
- Assess networking systems to identify security vulnerabilities.
- Represent security system setup and process results in written form.
- Discuss cutting-edge network security research and development.

Estimated Workload/ Time Commitment Per Week

Average of 18 - 20 hours per week

Required Prior Knowledge and Skills

This course will be very challenging, and learners are expected to learn the necessary technologies on their own time.

Proficient Mathematical Skills and Theoretical Understanding

- Algorithms
- Data Structures
- Computer Organization and Architecture
- Operating Systems
- Computer Networking

Strong Application Skills

- Ability to effectively read C code
- Ability to effectively read Python code
- Confidence executing the following programming languages:
    - Python
    - Java

Proficient Experience

- Familiarity with these tools to understand network traffic, binaries and web applications for your coursework:
  - Tcpdump
  - Ifconfig
  - Route
  - Ip
  - ping
  - Traceroute
- Basic computer network concepts:
  - TCP/IP
  - packet switching
  - network services architecture
  - network protocol stack (MAC layer and above)
  - basic network security concepts such as encryption/decryption, authentication, access control, identity/key management
- Basic network security concepts:
  - encryption/decryption
  - authentication
  - access control
  - identity/key management
- Operating systems:
  - Windows 10
  - Linux 64 bit
  - Mac OS X

Technology Requirements

Hardware

- Intel or AMD based computer with 8GB or more memory.
  - Note: 6GB is technically sufficient, but performance will be sluggish.
- Reliable, strong Internet connection
- Webcam
- Microphone

Software/Other

- VirtualBox 5.0 or Newer (available at https://www.virtualbox.org/wiki/Downloads).

- Windows 10, Mac OS X, or Linux 64-bit as base operation system.
    - **Note:** Knowing how to use the Linux OS is a plus.

The course project will be completed using the language that the learner chooses. However, the course team will not be able to help the learner if they choose any language that is not Python, Java, or C#.

Textbook and Readings

At the graduate level, inquiry, research, and critical reading are part of the learning experience; however, this course does not have a required textbook. Any required readings are provided within or are accessible through the course and the ASU Library.

For interested learners, the following textbook is recommended:

> *Software-Defined Networking and Security: From Theory to Practice*. Dijiang Huang, Ankur Chowdhary, and Sandeep Pisharody (CRC Press, 2018).

Course Schedule and Important Dates

Course teams will not be working on ASU's days off* and those are listed in the Course Schedule. Please review the ASU Days Off for more details.

Week/Title	Begins at 12:01 AM Arizona (AZ) Time	Ends at 11:59 PM Arizona (AZ) Time
Welcome and Start Here	October 7, 2022	October 16, 2022
Week 1: Computer Network Foundations	October 12, 2022	October 16, 2022
Week 2: Security Foundations	October 17, 2022	October 23, 2022
Week 3: Virtual Networks	October 24, 2022	October 30, 2022
Week 4: Software-Defined Networks and Network Functional Virtualization	October 31, 2022	November 6, 2022

(Daylight Savings Time Ends 11/6)		
Midterm Exam	November 6, 2022	November 13, 2022
Week 5: Security Measurement	November 7, 2022	November 13, 2022
Week 6: Anomaly Detection	November 14, 2022	November 20, 2022
Course Survey	November 22, 2022	December 1, 2022
Week 7: Moving Target Defense	November 21, 2022	November 27, 2022
Week 8:Trends, Future Directions	November 28, 2022	December 4 , 2022
Final Exam	November 26, 2022	December 4, 2022
Request for Faculty Review: MCS Portfolio Project Report Inclusion Request Optional and a degree-seeking learner degree requirement	November 21, 2022	December 18, 2022
Faculty Feedback for the Review: MCS Portfolio Project Report Inclusion Request Optional and a degree-seeking learner degree requirement	December 18, 2022	January 3, 2022

Grades are due December 12, 2022 . Please see the ASU Academic Calendar for additional information.

Assignment Deadlines and Late Penalties

Unless otherwise noted, all graded work is due on **Sundays at 11:59 PM Arizona (AZ) time**. For learners with accommodations through SAILS, please work with your SAILS consultant, Connect, and your instructor.

Graded Discussion Prompts

This course has a “Class Participation” requirement that will account for 5% of your final course grade. To fulfill this requirement, you must attend or watch a recording of a live event or participate in the course’s discussion forum(s) at least once a week. Discussion Forum participation may be either a substantive original post or a substantive reply, and it may comprise a question or comment about course material or be a share of (or comment on) links to course topic-related articles or papers that you think might be of interest to classmates. Simply saying “thank you” or posting brief, general comments in a discussion forum thread will not count towards this credit. Because Slack is not for course discussion, posts in Slack do not count toward class

Graded Quizzes

An automatic late penalty of 25% will be applied each day a quiz is submitted after the scheduled due date and time. These quizzes count toward your final grade in the class. ***Your lowest quiz score will be automatically dropped.***

- **Week 1 Graded Quiz** - due at the end of Week 1
- **Week 2 Graded Quiz** - due at the end of Week 2
- **Week 3 Graded Quiz** - due at the end of Week 3
- **Week 4 Graded Quiz** - due at the end of Week 4
- **Week 5 Graded Quiz** - due at the end of Week 5
- **Week 6 Graded Quiz** - due at the end of Week 6
- **Week 7 Graded Quiz** - due at the end of Week 7

Assignment(s)

- **Class Participation** - due at the end of Week 7

Project(s)

An automatic late penalty of 25% for each day late is applied to projects submitted after the scheduled due date and time. These projects count toward your final grade in the class.

- Project 1: Packet Filter Firewall (iptables) - due at the end of Week 2 on October 23, 2022 at 11:59 PM MST
- Project 2: SDN-Based Stateless Firewall - due at the end of Week 4 on November 6, 2022 at 11:59 PM MST
- Project 3: SDN-Based DoS Attacks and Mitigation - due at the end of Week 6 on November 20, 2022 at 11:59 PM MST
- Project 4: Machine Learning-Based Anomaly Detection Solutions - due at the end of Week 8 on December 4, 2022 at 11:59 PM MST

Exams

A single-automatic late penalty of 100% is applied after the scheduled due date and time.

- **Midterm Exam**- available from November 6, 2022 at 12:01 am - until November 13, 2022 MST until at 11:59 pm MST
- **Final Exam** - available from November 26, 2022 at 12:01 am MST until December 7, 2022 at 11:59 pm MST

Course Content

Each course in the MCS program is uniquely designed by expert faculty, so learners can best master the learning outcomes. As a result, course features and experiences are not the same across all MCS courses. Learners are expected to plan accordingly to accommodate for these differences.

Feedback Descriptions

The feedback descriptions are specific to auto-graded or auto-feedback items in the course.

- **Limited**: you will be able to see your Total Score, which includes the overall total percent (%) and the number (#) of points.
- **Partial**: you will be able to see your Question Score, which includes the correct or incorrect status and the total points for each question.
- **Full**: you will be able to see your Options and Feedback, which includes any itemized additional feedback.

Details of the main instructional and assessment elements in this course:

If you have specific questions related to instructional and assessment items in this course that you would like to be considered to be addressed in the weekly Live Event hosted by the instructor, please clearly indicate your request in your Coursera Discussion forum thread.

Lecture Videos

The concepts you need to know are presented through a collection of video lectures. You may play these videos within the browser or download the files to watch the videos offline. To further support learning, all of the videos include transcripts and most include PDF lecture slides. Transcript files appear under each video's "Download" tool and PDFs of lecture slides, when available, appear in the same place or in a reading at the start of each week.

Readings

Suggested readings may accompany topics. They are supplementary materials for you to further understand the course topics. Required reading citations accompany topics and are accessible through ASU's Library.

Recommended Resources

Please explore the recommended resources to deepen your knowledge and enhance your skills on the topics covered each week. Although the content in these resources will not be explicitly assessed, they may support your learning and successful completion of coursework.

Graded Discussion Prompts (Discussion Forum Participation)

Discussion forums: Cousera's provides built-in weekly discussion forums. Although the course team is engaged in these discussions, the forums are also spaces to support and enrich learner-to-learner communication and learning. For more information, please review the course communication-related readings in the "Welcome - Start Here!" section of Week 1.

Note: This course has a "Class Participation" requirement that will account for 5% of your final course grade. To fulfill this requirement, you must **attend or watch a recording of a live event** *or* **participate in the course's discussion forum(s)** at least once a week. Discussion Forum participation may be either a substantive original post or a substantive reply, and it may comprise a question or comment about course material or be a share of (or comment on) links to course topic-related articles or papers that you think might be of interest to classmates. Simply saying "thank you" or posting brief, general comments in a discussion forum thread will not count towards this credit. Because Slack is not for course discussion, posts in Slack do not count toward class participation.

Knowledge Checks

Designed to support your learning, these are short, ungraded quizzes to test your knowledge of the concepts presented in the lecture videos. You may take your time, review your notes, and learn at your own pace because knowledge checks are untimed. With unlimited attempts, you may retake these as often as you would like at any point in the course. You are encouraged to read the feedback provided, review your answer choices, and compare them to the correct answers. With the feedback as your guide, you may use these quizzes as opportunities to study for other assessments and tasks in the course. *There are no late penalties. Knowledge check quizzes are not counted towards your overall course grade.*

Practice Quizzes

There is a practice quiz to help prepare you for each graded quiz. You may retake these quizzes as often as you like at any point in the course. You are encouraged to read the full feedback, review your answer choices, and compare them to the correct answers. With the feedback as your guide, you may use these quizzes as opportunities to study for other assessments and tasks in the course. *There are no late penalties. These quizzes are not counted toward your final grade in the class.*

Graded Quizzes

Each week includes one (1) graded quiz. Each graded quiz comprises a relatively small number (approximately ten (10)) single- or multiple-select multiple choice questions. You will be allowed one (1) attempt for each of these quizzes. There is a 60-minute time limit to complete each quiz. Graded quizzes in this course include partial feedback. For academic integrity purposes, once grades are made available, learners will see their overall total scores. Correct and incorrect answers and feedback to each question will ***not*** be provided. Read the Graded Quiz and Exam Policy for more information. *An automatic late penalty of 25% will be applied each day a quiz is submitted after the scheduled due date and time. These quizzes count toward your final grade in the class.* ***Your lowest quiz score will be automatically dropped.***

Ungraded Background Labs

Preparatory "background" labs are available to help you develop proficiencies that you may not yet have but need to successfully complete each project. If you are new to VirtualBox, please do not skip the background lab CS-SYS-00101 (VM in VirtualBox) that is provided with Project 1.Each project will list the recommended background. These are not graded and will not count towards your final grade. The project page within the Welcome & Start Here section of the course provides an overview of the background labs and course projects.

Project(s)

This course includes four (4) individual projects. All projects are provided in the first week of the course in the *Welcome and Start Here* section, so you can preview what is expected and design your own learning schedules to complete these on time. As a set of three (3) or four (4), the projects may be included in the Request for Faculty Review: MCS Project Portfolio submission, which is optional. *An automatic late penalty of 25% for each day late is applied to projects submitted after the scheduled due date and time. These projects count toward your final grade in the class*
These projects count toward your final grade in the class.

- Project 1: Packet Filter Firewall (iptables)
- Project 2: SDN-Based Stateless Firewall
- Project 3: SDN-Based DoS Attacks and Mitigation
- Project 4: Machine Learning-Based Anomaly Detection Solutions

Request for Faculty Review: MCS Portfolio Project Report Inclusion Request

This is an optional task for degree students wanting to use this course's projects as part of their portfolio degree requirement/specialization requirements. Review your onboarding course and the Welcome and Start Here section of your course for more details. The submission space is towards the end of the course.

Although there are no late penalties, these requests must be submitted by the designated deadline. The Request for Faculty Review: MCS Portfolio Project Report Inclusion Request does not count toward your final grade in the class.

Address at least three (3) of the four (4) projects listed in the Projects section above in your Request for Faculty Review: MCS Project Portfolio Report.

- Request for Faculty Review: MCS Project Portfolio Report - December 18, 2022
- Faculty/instructor feedback should be received by - January 3, 2022

Example Exam Questions

To help you prepare for your proctored exam, a set of practice exam questions is provided. The questions may be discussed during live events.These are available in the Final Exam module in the course. *Practice exam questions are not counted toward your final grade in the class.*

Proctored Exam:

You have two (2) proctored and timed exams. This course includes a midterm and final exam. Proctored exams provide limited feedback. For academic integrity purposes, once grades are made available, learners will see their overall total scores. Correct and incorrect answers and feedback to each question will not be provided. Read the Graded Quiz and Exam Policy for more information. An automatic late penalty of 100% is applied to exams after the scheduled due date and time. No late exams will be permitted or accepted and will result in a score of zero points (0). This penalty does not apply to established accommodations for learners with disabilities. Proctored exams count toward your final grade in the class. No late exams will be permitted or accepted and will result in a score of zero points (0). This does not include established accommodations for learners with disabilities. Proctored exams count toward your final grade in the class.

Exam Details	Midterm Exam	Final Exam
Content Covered	Weeks 1-4	Weeks 5-8
Question Type	single- and multiple-answer multiple choice questions	single- and multiple-answer multiple choice questions
Number of Questions	31 total questions (30 content questions pulled randomly from a question bank + 1 academic integrity question)	20 total questions (19 content questions pulled randomly from a question bank + 1 academic integrity question)
Availability Start	November 6, 2022 at 12:01 AM AZ Time	November 26, 2022 at 12:01 AM AZ Time
Availability End	November 13, 2022 at 11:59 PM AZ time	December 7, 2022 at 11:59 PM AZ time
Last Available ProctorU Appointment	November 13, 2022 at 9:01 PM Phoenix time.	December 7, 2022 at 9:01 PM Phoenix time.
Duration	120 minutes + plan for at least 15 minutes for proctoring set up	120 minutes + plan for at least 15 minutes for proctoring set up

Midterm Exam Allowances

- **Hardcopy and/or digital books and/or reference materials (all)**: none
- **Calculators (all)**: none

- **Notes in any format of any kind (all)**: Six (6) sheets (both sides) of 8.5x11/A4 paper of handwritten notes ***OR*** four (4) sheets (both sides) of 8.5x11/A4 paper of typed/printed notes (printouts of lecture slides are NOT allowed)
- **Web (all)**: none
- **Software (all)**: none
- **Other technologies, devices, and means of communication (all)**: none
- **Whiteboard, scratch paper, writing utensils, erasing resources**: Learners are *strongly* encouraged to use the whiteboard option instead of scratch paper.
    - If using a whiteboard, learners may have erasable whiteboard markers and what is needed to erase writing on the whiteboard; please have extra whiteboard markers and eraser resources in your testing area.
    - If using scratch paper, learners may have two (2) sheets (both sides) of 8.5x11/A4 blank paper and writing utensils (e.g., pens, pencils, markers, and/or highlighters) and erasers; please have extra writing supplies in your testing area should you run out of ink, the pencil breaks, etc.
    - Before the exam concludes and the proctoring session ends, all scratch paper must be destroyed and all whiteboard markings must be erased. The last question in the exam will be a confirmation of learners executing these ASU academic integrity actions.
- **Other**: Learners are to independently take the exam in a single session without leaving the testing space (e.g., no bathroom breaks) to ensure proctoring of the entire session. Once you open the exam, your testing session begins. You will be allowed one (1) attempt to take and complete each exam. Learners are to stay within a clear view of the proctor throughout the duration of the proctored exam session. You will be unable to open the exam until the exam proctor enters the password during the date and time you scheduled to take your exam with ProctorU.
- **Reminder**: All virtual machines must be closed *prior* to starting proctoring.

Final Exam Allowances

- **Hardcopy and/or digital books and/or reference materials (all)**: none
- **Calculators (all)**: Built-in or physical calculator for **one question** (Q6, Question set 3 - 3.6)
- **Notes in any format of any kind (all)**: Six (6) sheets (both sides) of 8.5x11/A4 paper of handwritten notes ***OR*** four (4) sheets (both sides) of 8.5x11/A4 paper of typed/printed notes (printouts of lecture slides are NOT allowed)
- **Web (all)**: none
- **Software (all)**: none
- **Other technologies, devices, and means of communication (all)**: none
- **Whiteboard, scratch paper, writing utensils, erasing resources**: Learners are *strongly* encouraged to use the whiteboard option instead of scratch paper.
    - If using a whiteboard, learners may have erasable whiteboard markers and what is needed to erase writing on the whiteboard; please have extra whiteboard markers and eraser resources in your testing area.
    - If using scratch paper, learners may have two (2) sheets (both sides) of 8.5x11/A4 blank paper and writing utensils (e.g., pens, pencils, markers, and/or highlighters) and erasers; please have extra writing supplies in your testing area should you run out of ink, the pencil breaks, etc.
    - Before the exam concludes and the proctoring session ends, all scratch paper must be destroyed and all whiteboard markings must be erased. The last question in the exam will be a confirmation of learners executing these ASU academic integrity actions.
- **Other**: Learners are to independently take the exam in a single session without leaving the testing space (e.g., no bathroom breaks) to ensure proctoring of the entire session. Once you open the exam, your testing session begins. You will be allowed one (1) attempt to take and complete each exam. Learners are to stay within a clear view of the

proctor throughout the duration of the proctored exam session. You will be unable to open the exam until the exam proctor enters the password during the date and time you scheduled to take your exam with ProctorU.

- **Reminder**: All virtual machines must be closed *prior* to starting proctoring.

Proctoring

ProctorU is an online proctoring service that allows learners to take exams online while ensuring the integrity of the exam for the institution.

- You are expected to scan your testing space using your webcam for the proctor. Proctoring also requires you to have sound and a microphone. Please plan accordingly.
- You are strongly encouraged to schedule your exam(s) within the first two weeks of the course to ensure you find a day and time that works best for your schedule. Time slots can fill up quickly, especially during high volume time periods.
    - You *must* set up your proctoring at least 72 hours prior to the exam.
- **The exam proctor will input the exam password**.
- Additional information and instructions are provided in the *Welcome and Start Here* section of the course.
- **When you are going to schedule exams, you *must* pick "Coursera" as your institution.**
- Learners with exam accommodations through Student Accessibility and Inclusive Learning Services (SAILS) should not schedule exams until they receive an email invitation specifically for them from ProctorU.
- Your ID needs to be in English. See your MCS Onboarding Course for more information.

Course Grade Breakdown

Course Work	Quantity	Team or Individual	Percentage of Grade

Class participation	8		5%
Graded weekly quizzes**	7		25%
Projects Total***	1		40%
Project 1: Packet Filter Firewall (iptables)			10%
Project 2: SDN-Based Stateless Firewall			
Project 3: SDN-Based DoS Attacks and Mitigation			
Project 4: Machine Learning-Based Anomaly Detection Solution			
Midterm Exam	1		15%
Final Exam	1		15%

*The project(s) count for 30% or more of the overall course grade, so this is a portfolio eligible course. See the MCS Graduate Handbook for more information about the portfolio requirement if you are a degree student.

Grade Scale

You must earn a cumulative grade of 67% to earn a “C” in this course. You must earn at least a “C” to receive graduate credit. Final course grades will include pluses and minuses.

The instructor reserves the right to adjust individual grades based on, but not limited to: violations of academic integrity.

Grade Scale							
A+	≥97%	**B+**	≥84%	**C+**	≥72%	**E**	< 50%
A	≥93%	**B**	≥80%	**C**	≥67%		

A-	≥87%	**B-**	≥77%	**D+**	≥50%		

Grades below 59.99 result in a letter grade of E.

Live Events

This course has two types of live events: **Live Sessions** and **Virtual Office Hours**. Check the Live Events page in your course for your local time and access details. Although we try to be consistent for our learners' planning purposes, the Live Event schedule is subject to change throughout the course, so stay up-to-date on the event details by checking your Course Announcements and the Live Events page in your course.

You may join all live events from the course's Live Events page. The event's title will become active as a Zoom link 10 minutes before each event starts. You will also receive an email with a link to the Live Session or Virtual Office Hours the day before the event starts.

Read about the specific policies related to Live Events in the Policy section of this syllabus: Live Events, Policy Regarding Expected Classroom Behavior, and the Student Code of Conduct for more detailed information.

Live Sessions - Weekly

Live Sessions are a valuable part of the learning experience because learners can meet with the course instructor and fellow classmates to learn more about course topics, special topics within the field, and discuss coursework. If you are able to attend Live Sessions, you are strongly encouraged to do so. If you have specific questions or topics of interest to be discussed during Live Sessions, please indicate your request in an Ed Discussion thread. Although it may not be possible to address all requests during the Live Session, the instructor is interested in tailoring this time to your questions and interests. The instructor will be following a set agenda, so please be mindful of that when engaging in the Live Sessions.

Live Sessions hosted by the faculty will be recorded and uploaded to the course. To decide on the best time for you, please go to this Doodle Poll and vote on the Live Events time. Once the time is selected the syllabus and course will be updated.

Virtual Office Hours - Weekly

Virtual Office Hours offer a chance for learners to get their questions answered from the course team. Although the course team is responsive to trends in Ed Discussion and mcsonline@asu.edu emails, Virtual Office Hours focus on addressing learners' specific questions related to content: clarifications, reteaching, assessment review, etc. These sessions are not intended to address program or course design questions or feedback. Assistants do not have the authority to weigh in or make decisions regarding those items, so please do not include those at this time. These sessions are specific to helping learners learn materials and understand various course assessments. Feedback of that nature is best addressed in the communication channel: mcsonline@asu.edu and please include it in your course survey.

Almeajel's virtual office hour: Wednesdays from 9-10 AM Hours are recorded, but not uploaded into the course.

Slack Channel

This course will have a unique Slack workspace where you can communicate with your classmates.

You must join/access this workspace using your ASURITE credentials.

While your instructors have access to the Slack workspace, it is intended to provide a space to create community with your classmates. Please remember to follow the communication protocol pinned in your Slack channel to ensure that any questions or concerns you have are addressed in a timely manner. Also, please remember ASU's Academic Integrity policy, and refrain from sharing assessment questions, answers or solutions.

Course Outline with Assignments

Please review the ASU Days Off for more details. Course teams will not be working on ASU's days off.

Welcome and Start Here (October 7 - October 16)

Topics

- ☐ Academic Integrity
- ☐ Course Syllabus
- ☐ Required Prior Knowledge and Skills and Technology Requirements
- ☐ Course [Assignment(s) and/or Project(s)] Overview
- ☐ [Peer Review Information]
- ☐ Exam Information and ProctorU

Other Tasks

- ☐ Required Checkpoint: Technology Access and Installation
- ☐ Activity: Zeemap
- ☐ Discussion: Get to Know Your Classmates
- ☐ Schedule your proctoring with ProctorU for your proctored exam(s)
- ☐ Required Checkpoint: Getting Started Quiz

Graded Coursework

- ☐ N/A

Week 1: Computer Network Foundations (October 12 - October 16)

- ☐ Getting Started
- ☐ Computer Network Basics and Infrastructure
- ☐ Network Addresses
- ☐ Computer Networking Services

Other Tasks

- ☐ Complete “Get to Know Your Classmates” (discussion forum assignment)
- ☐ Attend and/or watch the recorded instructor’s Live Session

- ☐ Get set up with VirtualBox or make other arrangements with the instructor so that you're ready for the course projects
- ☐ Start Project 1
- ☐ Create your ProctorU account (if you do not already have one) and schedule your final exam proctoring appointment with ProctorU
- ☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Graded Coursework

- ☐ Getting Started Quiz
- ☐ Week 1 Graded Quiz

Week 2: Security Foundations (October 17 - October 23)

Topics

- ☐ Firewalls
- ☐ Intrusion Detection Systems
- ☐ Basics of Applied Cryptography

Other Tasks

- ☐ Attend and/or watch the recorded instructor's Live Session
- ☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU
- ☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Graded Coursework

- ☐ Week 2 Graded Quiz
- ☐ Project 1: Packet Filter Firewall (iptables)

Week 3: Virtual Networks (October 24 - October 30)

Topics

- ☐ Virtual Network Foundations
- ☐ IP Security

Other Tasks

- ☐ Start Project 2
- ☐ Attend and/or watch the recorded instructor's Live Session
- ☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.
- ☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Graded Coursework

- ☐ Week 3 Graded Quiz

Week 4: Software-Defined Networks and Network Functional Virtualization (October 31 - November 6) 11/6 Daylight Savings Time Ends

Topics

- ☐ Distributed Network Routing

- ☐ Network Function Virtualization

Other Tasks

- ☐ Attend and/or watch the recorded instructor's Live Session
- ☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.
- ☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Graded Coursework

- ☐ Week 4 Graded Quiz
- ☐ Project 2: SDN-Based Stateless Firewall

Midterm Exam (November 6 - November 13)

Reminders

- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- ☐ Covers content from weeks 1-4
- ☐ Review the exam details and allowances information for this exam.
- ☐ Prepare for the exam and complete the practice exam.

Week 5: Security Measurement (November 7 - November 13)

Topics

- ☐ Introduction to Models
- ☐ Attack Graph and Attack Tree
- ☐ Attack Countermeasure Tree

Other Tasks

- ☐ Attend and/or watch the recorded instructor's Live Session
- ☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.
- ☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.
- ☐ Start Project 3

Graded Coursework

- ☐ Week 5 Graded Quiz

Week 6: Anomaly Detection (November 14 - November 20)

Topics

- ☐ Anomaly Detection Models
- ☐ Feedforward Neural Networks

Other Tasks

- ☐ Attend and/or watch the recorded instructor's Live Session
- ☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.
- ☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.
- ☐ Check the course evaluation survey's availability dates (see the "Schedule" area near the top of the page and check the "Survey open" and "Survey close" dates for the **current session**) and complete the survey within the availability window.

Graded Coursework

- ☐ Week 6 Graded Quiz
- ☐ Project 3: SDN-Based DoS Attacks and Mitigation

Week 7: Moving Target Defense (November 21 - November 27)

Topics

- ☐ Introduction to Moving Target Defense
- ☐ Software-Defined Networking Approach
- ☐ MTD Case Studies

Other Tasks

- ☐ Attend and/or watch the recorded instructor's Live Session
- ☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.
- ☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.
- ☐ Complete the course evaluation survey if it is still available (check availability dates)
- ☐ Start Project 4
- ☐ Study for the Final Exam

Graded Coursework

- ☐ Week 7 Graded Quiz

Week 8: Trends, Future Directions, and Course Wrap-up (November 28 - December 4)

Topics

- ☐ Happening Now and Future Directions

Other Tasks

- [ ] Attend and/or watch the recorded instructor's Live Session

Graded Coursework

- [ ] Project 4: Machine Learning-Based Anomaly Detection Solutions
- [ ] Final exam (covers Weeks 5-8)

Final Exam (November 26 - December 7)

Reminders

- [ ] Complete the course survey before your final exam (strongly encouraged, appreciated, and used by the course team).
- [ ] Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- [ ] Covers content from weeks 5-8
- [ ] Review the details and allowances information for this exam.
- [ ] Prepare for the exam and complete the practice exam.

Policies

All ASU and Coursera policies will be enforced during this course. For policy details, please consult the MCS Graduate Handbook and the MCS Onboarding Course.

Graded Quizzes and Exams

Each course in the MCS program is uniquely designed by expert faculty so that learners can best master the learning outcomes specific to each course. By design, course features and experiences are different across all MCS courses.

In the MCS program, we strive to provide learners with exercises and applied practice beyond quizzes and exams that align with the hands-on nature of the computer science industry. Ungraded practice opportunities *may* include, but are not limited to: in-video-questions (IVQs), knowledge check quizzes (KCs), weekly (i.e., unit) practice quizzes, practice exams, and other assignments or

exercises. For all these learning activities, the questions and correct answers are provided to learners. When available, auto-generated typed feedback is built into the course to further help learners learn in real-time. Please thoroughly review your course to ensure that you are aware of the types of practice opportunities available to you.

[For academic integrity purposes, once grades are made available, learners will see their overall total scores. Like other standardized tests, such as the GRE and SAT, learners will receive a singular grade for the graded quizzes and exams, but the questions, correct and incorrect answers, and feedback to each question will ***not*** be provided.]

If learners desire 1:1 feedback for their questions on graded assessments, please submit questions to mcsonline@asu.edu. Rather than receiving the exact questions learners had correct and incorrect and the answers to those questions, learners will likely receive the concepts that were covered in the assessment questions so they will know what they need to review prior to other assessments and how to apply this information in their professional environments.

Absence Policies

There are no required or mandatory attendance events in this online course. Live Events, both Live Sessions hosted by the instructor and Virtual Office Hours hosted by the course team do not take attendance; however, learners must attend/view weekly live events or engage in the related discussion forums to earn their participation grades for this course. The instructor reserves the right to adjust individual grades based on, but not limited to: workload imbalance, inappropriate behavior, lack of productivity, etc.

Learners are to complete all graded coursework (e.g., projects and exams). If exceptions for graded coursework deadlines need to be made for excused absences, please reach out to the course team by the end of the second week of the course using the mcsonline@asu.edu email address. Review the exam availability windows and schedule accordingly. The exam availability windows allow for your own flexibility and you are expected to plan ahead. Personal travel does not qualify as an excused absence and does not guarantee an exception.

Review the resources for what qualifies as an excused absence and review the late penalties in the Assignment Deadlines and Late Penalties section of the syllabus and the course:

a. Excused absences related to religious observances/practices that are in accord with ACD 304–04, “Accommodation for Religious Practices” (please see Religious Holidays and Observances).

b. Excused absences related to university sanctioned events/activities that are in accord with ACD 304–02, “Missed Classes Due to University-Sanctioned Activities”.

c. Excused absences related to missed class due to military line-of-duty activities that are in accord with ACD 304–11, “Missed Class Due to Military Line-of-Duty Activities,” and SSM 201–18, “Accommodating Active Duty Military”.

Live Event Expectations

The environment should remain professional at all times. Inappropriate content/visuals, language, tone, feedback, etc. will not be tolerated, reported and subject to disciplinary action. Review the Policy Regarding Expected Classroom Behavior section of the syllabus and the Student Code of Conduct for more detailed information.

Policy Regarding Expected Classroom Behavior

The aim of education is the intellectual, personal, social, and ethical development of the individual. The educational process is ideally conducted in an environment that encourages reasoned discourse, intellectual honesty, openness to constructive change, and respect for the rights of all individuals. Self-discipline and a respect for the rights of others in the university community are necessary for the fulfillment of such goals. An instructor may withdraw a student from a course with a mark of “W” or “E” or employ other interventions when the student’s behavior disrupts the educational process. For more information, review SSM 201–10.

If you identify something as unacceptable classroom behavior in any communication channel (e.g., Ed Discussion, Zoom, Live Events, Slack, etc.), please notify the course team using the mcsonline@asu.edu email. For more specifics on appropriate participation, please review our Netiquette infographic.

Our classroom community rules are to:

- Be professional
- Be positive
- Be polite
- Be proactive

Academic Integrity

Students in this class must adhere to ASU's academic integrity policy, which can be found at https://provost.asu.edu/academic-integrity/policy). Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. In addition, all engineering students are expected to adhere to both the ASU Academic Integrity Honor Code and the Fulton Schools of Engineering Honor Code. All academic integrity violations will be reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). The AIO maintains a record of all violations and has access to academic integrity violations committed in all other ASU colleges/schools.

Copyright

The contents of this course, including lectures (Zoom recorded lectures included) and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions is authorized only for the use of students enrolled in this course during their enrollment in this course. Recordings and excerpts of recordings may not be distributed to others. (see ACD 304–06, "Commercial Note Taking Services" and ABOR Policy 5-308 F.14 for more information).

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's/learner's original work, unless the student/learner first complies with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Policy Against Threatening Behavior, per the Student Services Manual, (SSM 104-02)

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services (see SSM 104-02). Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

Disability Accommodations

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with ASU Student Accessibility and Inclusive Learning Services. Students should communicate the need for an accommodation at the beginning of each course so there is sufficient time for it to be properly arranged. These requests should be submitted through the online portal. See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities. ASU Student Accessibility and Inclusive Learning Services will send the instructor of record a notification of approved accommodations and students are copied on these letters. It is recommended that students reply to the faculty notification letters, introduce themselves to their instructor, and share anything they might want to disclose.

Harassment and Sexual Discrimination

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

Mandated sexual harassment reporter: As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

Disclaimer

The information in this syllabus may be subject to change without advance notice. Stay informed by checking course announcements and the syllabus section of your course.

Course Creator(s)

The following faculty member created this course.

Dijiang Huang

Dr. Dijiang Huang is an associate professor in the School of Computing Informatics and Decision Systems Engineering. He teaches Computer Network and Security (CSE468) at the undergraduate level and Advanced Computer Network and Security (CSE548) at the graduate levels. In addition, he had taught computer science courses such as Computer Networks (CSE434), Cloud Computing (CSE 546), Concepts of Computer Science and Data Structure (CSE 205), Data Structures and Algorithm (CSE 310), and Introduction to Computer Science and Engineering (CSE 101) at Arizona State University. Dr. Huang received his Bachelor of Science degree in Telecommunications from Beijing University of Posts & Telecommunications, China, and his Computer Science and Telecommunications Master of Science degree and Ph.D. from the University of Missouri-Kansas City.