	**SULTAN QABOOS UNIVERSITY** **COLLEGE OF SCIENCE** **DEPARTMENT OF COMPUTER SCIENCE** **BACHELOR OF SCIENCE IN COMPUTER SCIENCE** **COURSE OUTLINE**

I. COURSE INFORMATION			
COURSE CODE	**COMP5509**		
COURSE TITLE	**Penetration Testing and Ethical Hacking**		
OMAN QUALIFICATION FRAMEWORK (OQF) LEVEL	**8**		
CREDIT HOURS	3		
CONTACT HOURS	4		
PRE-REQUISITES	COMP4509 or COMP5507		
CO-REQUISITES	-		
EQUIVALENT COURSES			
INCOMPATIBLE COURSES			
COURSE CATEGORY	☐ University Requirement	☐ University Elective	
	☐College Requirement	☐ College Elective	
	☐Department Requirement	☐ Department Elective	
	☐ Major Requirement	☐ Major Elective	
	☒ Specialization Requirement	☐ Specialization Elective	
	☐ Other (specify):		
COURSE OWNER	College: Science	Department: Computer Science	
	Center:	Unit:	
DELIVERY MODE	☒ Face to Face	☐ Blended	☐ Online
COURSE TYPE	☐ Lecture	☒ Lecture/Lab	

	☐ Lecture/Seminar	☐ Lecture/Studio	
	☐ Lecture/Tutorial	☐ Lecture/Lab/Tutorial or Seminar	
	☐Tutorial	☐ Laboratory (Practical)	
	☐ Field or Work Placement	☐ Studio	
	☐Seminar	☐ Internship	
	☐ Workshop	☐ Project	
	☐ Thesis	☐ Other (specify):	
LANGUAGE OF INSTRUCTION	English		
COURSE DESCRIPTION	Introduction to the principles and techniques associated with the cyber security practice known as penetration testing or ethical hacking. The course covers planning, reconnaissance, scanning, exploitation, post-exploitation, and result reporting. The student discovers how system vulnerabilities can be exploited and learns to avoid such problems. Topics included are network and system attacks, O.S foot-printing, port scanning, Embedded O. S. attacks, Web server hacking, wireless networks vulnerabilities, firewalls and intrusion detection systems		
TEACHING AND LEARNING STRATEGIES	☐ Augmented Reality	☐ Flipped Classroom	
	☒ Blended Learning	☒ Problem-Based Learning	
	☐ Discovery-Based Learning	☐ Project-Based Learning	
	☐ Student-Led Learning	☐ Team-Based Learning	
	☐ Work-Based Learning	☐ Other (specify):	
ASSESSMENT COMPONENT AND WEIGHT	☒ In-term examination(s) (20%)	☐ Quizzes	☐ Other (specify):
	☒ Homework assignments (10%)	☒Project Coursera (10%)	
	☒ Final examination (40 %)	☒ Practical/ Lab (20%)	
TEXTBOOKS AND EDUCATIONAL MATERIAL	Michael T. Simpson, Kent Backman, James E.Corley, (2011). Hands-On Ethical Hacking and Networking Defense, 2nd Ed. Cengage Learning. ISBN-13: 978-1-4354-9665-1		
GRADING METHOD	☒ A-F Scale	☐ Pass/Not Pass	☐ Other (specify):
GRADING METHOD DESCRIPTION			

	Range	Letter Grade	Description
A-F GRADING SCALE:	90 – 100	A	**Exceptional performance:** All course objectives achieved and met in a consistently outstanding manner.
	86 – 89.9	A-	
	81– 85.9	B+	**Very Good Performance:** The majority of the course objectives achieved (majority being at least two-thirds) and met in a consistently thorough manner.
	77 – 80.9	B	
	73 – 76.9	B-	
	68 – 72.9	C+	**Satisfactory Performance:** At least most of course objectives have been achieved and met satisfactorily.
	64 – 67.9	C	
	60 – 63.9	C-	
	55 – 59.9	D+	**Minimally Acceptable Performance:** The course objectives met at a minimally acceptable level.
	50 – 54.9	D	
	0 – 49.9	F	**Unacceptable performance:** The course objectives not met at a minimally acceptable level.
PASS/NOT PASS:			
OTHER:			

II. SEMESTER INFORMATION			
SEMESTER/YEAR	Spring 2025	**SECTION(S)**	1
DAY AND TIME	Mon - WED	**VENUE(S)**	Theater 2 (lecture) Lab19A/1, Lab19B/2
COURSE COORDINATOR	Prof. Abderezak Touzene	**COURSE TEAM**	
COORDINATOR OFFICE	0019	**OFFICE HOURS**	**SUN, TUES 10 – 11**
COORDINATOR EXTENSION	1482	**COORDINATOR EMAIL**	touzene@squ.edu.om

III. Alignment of Course Learning Outcomes (CLO), Program Learning Outcomes (PLO), Graduate Attributes (GA), and Oman Qualification Framework (OQF) Characteristics			
CLO	**PLO / SO**	**SQU Graduate Attributes**	**OQF Characteristics**
1. Understand the basics of computer based vulnerabilities	**SO1, SO2**	**A, B**	**1, 2**
2. Understand the different foot printing, reconnaissance and scanning methods.	**SO1, SO2**	**A, B**	**1, 2**
3. Explain and apply principles of ethical hacking for professional responsibilities	**SO4**	**B, E**	**2, 4**
4. Demonstrate the enumeration and vulnerability analysis methods	**SO1, SO2**	**A, B**	**1, 2**
5. Acquire knowledge on the options for network protection.	**SO1, SO2**	**A, B**	**1, 2**
6. Use tools to perform ethical hacking to expose the vulnerabilities	**SO1, SO2**	**A, B**	**1, 2**

IV. Course Learning Outcomes (CLOs) and Assessment Criteria and Methods (for each CLO)		
CLO1: Understand the basics of computer based vulnerabilities		
Assessment Criteria (to achieve this objective, the student must)		**Assessment Methods**
A)	Describe the vulnerabilities of Microsoft operating systems and services	Midterm, Lab test ,Final Exam
B)	Use Tools to assess Microsoft system vulnerabilities	
C)	Demonstrate understanding of the Techniques to harden Microsoft systems against common vulnerabilities	
CLO2: Understand the different foot printing, reconnaissance and scanning methods.		
Assessment Criteria (to achieve this objective, the student must)		**Assessment Methods**
A)	Describe port scanning	Midterm, Lab test, Project, Final Exam
B)	Use various port-scanning tools	
C)	Develop scanning shell scripting programs	

CLO3: Explain and apply principles of ethical hacking for professional responsibilities		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Demonstrate understanding of the principals of Ethical Hacking	HW1, Midterm, Final Exam
B)	Describe Role of an ethical Hacker	
C)	Describe what you can do legally as an ethical hacker	
D)	Demonstrate understanding of the steps of penetration testing	
CLO4: Demonstrate the enumeration and vulnerability analysis methods		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Describe the enumeration step of security testing	Midterm, Lab test ,Final Exam
B)	Use Enumerate Microsoft OS and *NIX OS targets	
C)	Use enumeration tools: Netbios enumeration; SNMP enumeration; SMTP enumeration	
CLO5: Acquire knowledge on the options for network protection.		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Demonstrate understanding of the concept of Network Protection systems	Final Exam
B)	Demonstrate understanding of the different types of Firewalls	
C)	Demonstrate understanding of the different Intrusion Detection Systems	
CLO6: Use tools to perform ethical hacking to expose the vulnerabilities		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Use tools for general information gathering	HW2, Midterm, Lab test ,Final Exam
B)	Use tools for technical information gathering	
C)	Use tools for scanning and footprint	
D)	Use tools for vulnerability testing and exploitation	

V. COURSE CONTENT AND SCHEDULE				
WEEK	**LECTURES #**	**TOPICS/ SUBJECTS**	**READINGS/ CHAPTERS**	**REMARKS (e.g., ASSESSMENTS)**
1, 2	Lecture 1 Lecture 2	**Ethical Hacking Overview:** Introduction to Ethical Hacking. The Role of Security and Penetration Tester. Penetration-Testing Methodologies. Certification Programs for Network Security Personnel. Laws of the Land. Recent Hacking Cases. Federal Laws. Anti-Spam Vigilantes	Chapter 1	HW1, Midterm, Final Exam
3	Lecture 3 Lecture 4	**TCP/IP Concepts Review** Overview of TCP/IP. Four Different Layers of TCP/IP Protocol Stack. Basic Concepts of IP Addressing.	Chapter 2	HW1, Midterm, Final Exam
4	Lecture 5 Lecture 6	**Technical Information Gathering:** What are the technical information of the target; How to collect the technical information; Identifying the network range of the target; Tools used for technical information gathering: whois, Netcraft, Shodan, Robtex, Foca, Maltego.	Chapter 3	HW1, Midterm, Lab test, Final Exam
5	Lecture 7 Lecture 8	**Network and Computer Attacks:** Different Types of Malicious Software. Methods of Protecting Against Malware Attacks. Types of Network Attacks. Physical Security Attacks and Vulnerabilities	Chapter 4	HW1, Midterm, Lab test, Final Exam
6	Lecture 9 Lecture 10	**Social Engineering Hacking** What is social engineering and how it works; History of Social Engineering; Main techniques that are used; Method of Prevention	Chapter 5	HW2, Midterm, Lab test, Final Exam
7	Lecture 11 Lecture 12	**Port Scanning:** Port Scanning Overview. Different Types of Port Scans. Port-Scanning Tools. To Conduct Ping Sweeps. Shell Scripting	Chapter 6	HW2, Midterm, Lab test, Final Exam
8	Lecture 13	**Enumeration:** Enumeration Step of Security Testing. Enumerate Microsoft	Chapter 7	HW2, Midterm,

	Lecture 14	OS Targets. Enumerate NetWare OS Targets. Enumerate *NIX OS Targets		Lab test, Final Exam
9, 10	Lecture 15 Lecture 16	**Desktop and Server OS Vulnerabilities:** Describe the Vulnerabilities of Windows and Linux Operating Systems. Identify Specific Vulnerabilities and Explain Ways to Fix them. Protections.	Chapter 8	Project, Midterm, Final Exam
11, 12	Lecture 17 Lecture 18	**Hacking Databases and Web Servers:**Web Application Vulnerabilities. The Tools Used to Attack Web Servers and databases	Chapter 9	Project , Midterm Exam, Final Exam
13	Lecture 19 Lecture 20	**Hacking Wireless Networks:** Wireless Networking Standards. Process of Authentication. Wireless Hacking and Tools	Chapter 10	Project, Final Exam
14	Lecture 21 Lecture 22	**Network Protection Systems** Network Security Devices. Firewall Technology. Intrusion Detection Systems. Honeypots.	Chapter 11	Final Exam
15		Term Project Presentations and report		Final Exam

VI. ADDITIONAL INFORMATION (e.g., RUBRICS, etc.)

Assessment Plan (*tentative*):

Item	Date In	Due Date	Weights
Homework 1	(W3) Mon	(W5) Wed	5%
Homework 2	(W5) Mon	(W7) Wed	5%
Midterm Exam	(W9) Wed		20%
Project (2) / Coursera guided project (2) (Report & presentation)	(W7) Mon	(W15) Wed	10%
Lab test	(W13) Wed		20%
Final Exam	29/05/2025	(08:00 - 10:50)	40%

Department's Late Submission Policy:

(a) 1-24 hours: 25% of the mark will be deducted.
(b) > 24 hours: Not accepted.

Department's Policy for Dealing with Cheating:

It is essential that each student solves all programming assignments, lab tests and exams individually unless instructed otherwise, e.g., for group projects. Copying, plagiarism, collusion, switching, and falsification are violations of the university academic regulations. Students involved in such acts will be severely penalized. The department has adopted a firm policy on this issue. A zero mark will be assigned the first time a student is caught involved in copying and his/her name will be added to a watch list maintained by the Head of Department. Further repeated involvements in copying will cause the student to get an F grade in that course. This is in line with the university academic regulations.

VII. STUDENTS RESPONSIBILITIES

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include attendance requirements and student academic code of conduct.

ACADEMIC INTEGRITY	The University expects the students to approach their academic endeavors with the highest academic integrity. Please refer to the **Undergraduate Academic Regulations**.
ADD AND DROP	Students who wish to drop or add the course should review the **Undergraduate Academic Regulations**.
ATTENDANCE	Sultan Qaboos University has a clear requirement for students to attend courses, detailed in the **Undergraduate Academic Regulations**.
ASSESSMENT AND GRADING	To ensure the provision of a sound and fair assessment and grading, please review the **Undergraduate Academic Regulations**.
GRADE APPEAL	Students who wish to appeal their grades should review the **Undergraduate Academic Regulations**.
CLASSROOM POLICIES	Students are expected to dress professionally during class time as required by the University. Use of phones or any other electronic devices in the classroom during class time is strictly prohibited. Unauthorized use may lead to faculty member confiscation of the device for the remainder of the class. Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. A student responsible for disruptive behavior may be required to leave the class.
LATE AND	Students are required to meet the course objectives by submitting coursework no later than the assigned due date. Students may be allowed to submit late work if

MAKE-UP WORK	approved by the course coordinator. Assignments submitted after the due date may be penalized.
MISSED EVALUATIONS	All quizzes, tests, clinical evaluations, and exams must be completed by the date they are assigned. If a quiz, test, or exam is missed due to a documented emergency situation (e.g., medical emergency, death in the immediate family), it is the student's responsibility to contact the instructor.
OTHER	

Course Outline Appendix

A. PROGRAM LEARNING OUTCOMES

SO1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

SO2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program discipline.SO3. Communicate effectively in a variety of professional contexts.

SO4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

SO5. Function effectively as a member or leader of a team engaged in activities appropriate to the program discipline.

SO6. Apply computer science theory, software development fundamentals to produce computing-based solutions.

B. SQU Graduate Attributes and Competencies for Undergraduate Studies

GRADUATE ATTRIBUTES	GRADUATE COMPETENCIES FOR UNDERGRADUATE STUDIES
A. Cognitive Capabilities: The graduate has sufficient general and specialized theoretical knowledge that enables him/her to deal well with his/her specialty and other related fields.	1. Demonstrates familiarity and works with advanced specialized knowledge in the area of specialization.
	2. Demonstrates a general understanding of the relationship of advanced specialized knowledge with knowledge in other relevant professional fields and aspects.
	3. Demonstrates a comprehensive understanding of the theories, principles, and methods used in his/her specialty, and how to create and apply new knowledge.
	4. Demonstrates general knowledge of the legal environment and necessary relevant regulatory

	frameworks.
	5. Shows awareness of contemporary literature and research.
B. Skill and Professional Capability: The graduate has sufficient skill and practical experience that enables him/her to perform all tasks related to the specialization and other related fields.	1. Applies concepts, theories, and investigative methods to synthesize and interpret information to evaluate conclusions.
	2. Applies appropriate research methods and techniques and employs digital knowledge
	3. Evaluates and critiques information independently
	4. Uses cognitive and technical skills to analyze complex issues and develop appropriate solutions.
	5. Initiates new ideas or processes in the professional, educational or research context.
C. Effective Communication: The graduate has the ability to communicate effectively with others to achieve the desired results	1. Explains, presents, and adapts information to suit the recipients.
	2. Employs appropriate information and communication technology to collect and analyze information.
D. Autonomy and Leadership: The graduate has the ability to lead, make decisions and take responsibility for decisions.	1. Performs advanced professional activities independently.
	2. Demonstrates leadership skills.
	3. Takes professional responsibility.
	4. Assumes full accountability for the tasks and their output.
E. Responsibility and Commitment: The graduate appreciates the importance of available resources and deals with them effectively and is committed to the ethics of the profession and society.	1. Manages time and other resources assigned to accomplishing tasks effectively and responsibly.
	2. Demonstrates effective practices when working in teams.
	3. Demonstrates advanced levels of understanding of values and ethics relevant to the specialization, profession and local and international society and

	promotes them among others.
	4. Works within the professional, institutional, and specialization guiding frameworks and strategic plans.
	5. Interacts with community affairs positively and preserves national identity.
F. Development and Innovation: The graduate has a passion for development and innovation in the field of specialization.	1. Demonstrates the ability to independently manage learning tasks, with an awareness of how to develop and apply new knowledge.
	2. Utilizes specialized knowledge and skills for entrepreneurship.
	3. Utilizes creative and innovative skills in the field of specialization.

C. OQF CHARACTERISTICS

1. Knowledge
2. Skills
3. Communication, Numeracy, and Information and Communication Technology Skills.
4. Autonomy and Responsibility
5. Employability and Values
6. Learning to learn