SULTAN QABOOS UNIVERSITY

COLLEGE OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE OUTLINE

I. COURSE INFORMATION			
COURSE CODE	COMP4506		
COURSE TITLE	Systems and Networks Programming		
OMAN QUALIFICATION FRAMEWORK (OQF) LEVEL	7		
CREDIT HOURS	3		
CONTACT HOURS	4		
PRE-REQUISITES	COMP4501 AND (COMP3502 OR COMP4502)		
CO-REQUISITES	-		
EQUIVALENT COURSES			
INCOMPATIBLE COURSES			
COURSE CATEGORY	☒ Specialization Requirement		
COURSE OWNER	College: Science	Department: Computer Science	
	Center:	Unit:	
DELIVERY MODE	☒ Face to Face	☐ Blended	☐ Online
COURSE TYPE	☒ Lecture/Lab		
LANGUAGE OF INSTRUCTION	English		
COURSE DESCRIPTION	This course aims to provide understanding and practice in writing system programs and shell scripts, manipulating system calls, programming tools, system processes and threads, system I/O, system permissions, files, directories and inter-process communication and multithreading.		

TEACHING AND LEARNING STRATEGIES	☒ Work-Based Learning	☒ Problem-Based Learning	
ASSESSMENT COMPONENT AND WEIGHT	☒ In-term examination(s) (20 %)	☐ Quizzes	☐Other
	☒ 4 Homework assignments (20 %)	☐Project	
	☒ Final examination (40 %)	☒ Lab Test (20 %)	
TEXTBOOKS AND EDUCATIONAL MATERIAL	No Textbook. Handouts (slides) will be available on Moodle. **Reference Book:** The Linux Programming Interface: A Linux and UNIX System Programming Handbook, by Michael KerrisK, William Pollock		
GRADING METHOD	☒ A-F Scale	☐ Pass/Not Pass	☐ Other (specify):

GRADING METHOD DESCRIPTION

A-F GRADING SCALE:

Range	Letter Grade	Description
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.

II. Semester Information			
Semester/Year	Fall 2024	**Section(s)**	10/11
Day and Time	MON – WED: 10:00 - 11:50	**Venue(s)**	MON: E11, WED: 1031N
Course Coordinator	Prof. Khaled Day	**Course Team**	
Coordinator Office	0007	**Office Hours**	SUN, TUE: 11 – 12
Coordinator Extension	2231	**Coordinator Email**	kday@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. Effectively apply software systems and tools under Unix/Linux, underpinned by a knowledge of how those systems work.	**2**	**A, D**	**1, 3**
2. Implement software designs to provide working solutions under Unix/Linux.	**2, 6**	**A**	**1**
3. Master basic Unix/Linux tools.	**2**	**A**	**1**
4. Implement basic Unix/Linux (operating system) operations such as create and kill processes and threads.	**2**	**A**	**1**
5. Apply file I/O operations (i.e. open, close, read, write, seek).	**2**	**A**	**1**
6. Apply Shell programming.	**2, 6**	**A**	**1**
7. Effectively handle signals and exceptions within a process.	**2, 6**	**A**	**1**
8. Become familiar with basic IPC techniques in Unix/Linux programming.	**2, 6**	**A**	**1**

IV. Course Learning Outcomes (CLOs) and Assessment Criteria and Methods (for each CLO)		
CLO1: Effectively apply software systems and tools under Unix/Linux, underpinned by a knowledge of how those systems work.		
Assessment Criteria (to achieve this objective, the student must)		**Assessment Methods**
A)	Perform Linux installation	Lab Exercise
B)	Apply basic Linux shell commands	Homework, Lab Test
C)	Apply program editing and compilation under Linux	Homework, Lab Test
CLO2: Implement software designs to provide working solutions under Unix/Linux.		
Assessment Criteria (to achieve this objective, the student must)		**Assessment Methods**
A)	Design and implement client-server programs	Homework, Midterm, Lab Test, Final
B)	Design and implement multithreaded programs	Homework, Midterm, Lab Test, Final
C)	Design and implement thread synchronization	Homework, Midterm, Lab Test, Final
CLO3: Master basic Unix/Linux tools.		
Assessment Criteria (to achieve this objective, the student must)		**Assessment Methods**
A)	Apply configuration of environment variables	Homework, Midterm, Lab Test, Final
B)	Apply files and directories operations	Homework, Lab Test
C)	Apply users and groups operations	Homework, Midterm, Lab Test, Final

CLO4: Implement basic Unix/Linux (operating system) operations such as create and kill processes and threads.		
Assessment Criteria (to achieve this objective, the student must)		**Assessment Methods**
A)	Understand and apply shell commands and system calls	Homework, Midterm, Lab Test, Final
B)	Understand and apply process operations	Homework, Midterm, Lab Test, Final
C)	Understand and apply thread operations	Homework, Midterm, Lab Test, Final

CLO5: Apply file I/O operations (i.e. open, close, read, write, seek).		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Explain file I/O operations: open, close, read, write, seek	Homework, Midterm, Final
B)	Apply file I/O operations: open, close, read, write, seek	Homework, Lab Test
CLO6: Apply Shell programming.		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Write basic shell scripts using Unix/Linux commands, local and environment variables, shell operators, and shell logic structures.	Homework, Midterm, Lab Test, Final
B)	Apply shell programming for accomplishing given tasks.	Homework, Midterm, Lab Test, Final
CLO7: Effectively handle signals and exceptions within a process.		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Describe the signal delivery and handling mechanism.	Homework, Midterm, Final
B)	Describe the effect of the different signals.	Homework, Midterm, Final
C)	Apply signal sending and handling within processes.	Homework, Midterm, Lab Test, Final
CLO8: Become familiar with basic IPC techniques in Unix/Linux programming.		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Demonstrate how to use sockets for IPC.	Homework, Midterm, Lab Test, Final
B)	Demonstrate how to use message queues for IPC.	Homework, Midterm, Lab Test, Final
C)	Demonstrate how to use shared memory for IPC.	Homework, Midterm, Lab Test, Final

V. COURSE CONTENT AND SCHEDULE				
WEEK	**LECTURE #**	**TOPICS/ SUBJECTS**	**READINGS/ CHAPTERS**	**REMARKS (e.g., ASSESSMENTS)**
1	Lecture Lab	Unix/Linux Overview Preparation for Using Linux and C	Slides 1 Chap 1	HW1, Midterm, Lab Test, Final
2	Lecture Lab	OS Concepts Basic Linux Commands	Slides 2 Chap 2	HW1, Midterm, Lab Test, Final
3	Lecture Lab	Shell Programming Shell Programming Exercises	Slides 3	HW1, Midterm, Lab Test, Final
4	Lecture Lab	Shell Programming Shell Programming Exercises	Slides 3	HW1, Midterm, Lab Test, Final
5	Lecture Lab	Networking Concepts Networking Exercises	Slides 4	HW2, Midterm, Lab Test, Final
6	Lecture Lab	Processes and Threads Networking Exercises	Slides 5 Chap 6, 24-26	HW2, Midterm, Lab Test, Final
7	Lecture Lab	Processes and Threads Processes Exercises	Slides 5 Chap 6, 24-26	HW2, Midterm, Lab Test, Final
8	Lecture Lab	Signals Threads Exercises	Slides 6 Chap 20	HW3, Lab Test, Final
9	Lecture Lab	Review for Midterm Exam Signals Exercises	- Chap 20	HW3, Lab Test, Final
10	Lecture Lab	Midterm Exam Signals Exercises	- Chap 20	HW3, Lab Test, Final
11	Lecture Lab	File I/O File I/O Exercises	Slides 7 Chap 4	HW4, Lab Test, Final
12	Lecture Lab	File I/O File I/O Exercises	Slides 7 Chap 4	HW4, Lab Test, Final
13	Lecture Lab	Interprocess Communication (IPC) IPC Exercises	Slides 9 Chap 53-54	HW4, Lab Test, Final
14	Lecture Lab	Interprocess Communication (IPC) IPC Exercises	Slides 9 Chap 53-54	HW4, Lab Test, Final
15	Lecture Lab	Review Lab Test	All Material	Final

VI. Additional Information (e.g., Rubrics, etc.)

Assessment Plan

	Date Out	Due Date	Weight
HW1	W3	W5	5%
HW2	W5	W7	5%
Midterm	W9		20%
HW3	W10	W12	5%
HW4	W12	W14	5%
Lab test	W15		20%
Final Exam	07 Jan 2025, 15:00 – 18:00		40%

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 Make-Up Work	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 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.

Course Outline Appendix

1. 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's 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's discipline.

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

2. 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	1. Manages time and other resources assigned to accomplishing tasks effectively and responsibly.

available resources and deals with them effectively and is committed to the ethics of the profession and society.	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.

3. 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