COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences

PROGRAM (S) TO BE EVALUATED BS Computer Science

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled-out form should not be more than 2-3 pages.)

Course Code	CS2006
Course Title	Operating Systems
Credit Hours	3+1
Prerequisites by Course(s) and Topics	ITC & Data Structures
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Midterms 30% Assignments & class activities 10% Projects 10% Final Exam 50%
Course Coordinator	Dr. Ghufran Ahmed
URL (if any)	https://classroom.google.com/u/0/c/Mzg4NzU1NTM4ODcy
Current Catalog Description	Introduction to operating systems, Operating system structures and design, Process Concepts, Inter-process Communication, Process scheduling, FCFS, SJF, SRTF, Priority, RR, multiprocessor, real-time, thread scheduling and threads security by scope of threads. Memory management techniques segmentation, fragmentation, paging, structure of page table, Virtual memory, COW, page replacement algorithms, FCFC, optimal, LRU, second chance, Frame allocation, thrashing, Kernel memory, buddy, slab. Process Synchronization, Peterson solution, test and set instruction, mutex lock, semaphore, classical problems, bounded buffer, reader writer, dinning philosopher. Deadlock detection, prevention, avoidance method, banker's algorithm resource request algorithm and protection and security of resources and processes. Disk scheduling FCFS, SSTF, SCAN, CSCAN, LOOK, CLOOK, protection and security introduction.

Textbook (or **Laboratory Manual** for Laboratory Courses)	✓ Operating system Concepts by Silberschatz 10th Edition. ✓ Linux Fundamentals by Paul Cobbaut ✓ Shell Scripting by Steve Parker ✓ System Software (An Introduction to System Programming) 3rd Edition by Leland L. Beck
Reference Material	✓ Modern Operating Systems by Andrew S. Tanenbaum ✓ Operating System Internal Designs & Principles by William Stallings (latest Edition) ✓ How Linux Works by Brian Ward 2nd Edition. ✓ System Programming with C and Unix by Adam Hoover

Course Goals

A. Course Learning Outcomes (CLOs)

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
01	Understand the characteristics of different structures of the Operating Systems and identify the core functions of the Operating Systems.	Cognitive	3	2	**CA, M1, F**
02	Analyze and evaluate the algorithms of the core functions of the Operating Systems and explain the major performance issues about the core functions.	Cognitive	4	3	**CA, M2, F**
03	Demonstrate the knowledge in applying system software andtools available in modern operating systems.	Cognitive	5	5	**A, P, F**

Tool: A = Assignment, Class Activities = CA, P=Project, M = Midterm, F=Final,

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

02	**Problem Analysis:** Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.
03	**Design/Develop Solutions:** Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
05	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	2	3	4	5	6	7	8	9	10
CLOs	1		✔								
	2			✔							
	3					✔					
	4										
	5										
	6										
	7										

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Introduction to Operating system: basic OS definition, computer organization, I/O, DMA, mass storage, protection, UMA and NUMA architecture, symmetric & asymmetric clustering, security, computing platforms.	**1.5**	**4**	**1**
Operating system structure: basic concept CLI, GUI, scripts, API, system programming & goals, OS design principles.	**1.5**	**4.5**	**1,3**
Process Concept: basic concept, scheduler types, Queues, process creation, interprocess communication methods.	**1**	**4**	**1,2,3**
Process scheduling Algorithm: pre-emptive & non –preemptive, FCFS, SJF, SRTF, Priority, RR, multiprocessor, real –time scheduling.	**1.5**	**4**	**1,2,3**

	Multi-threaded Programming: basic control blocks, thread models, thread concepts, process vs. threads, data and task parallelism, Amdahl's law, pthread APIs, OpenMP, threads security by scope of threads	**1.5**	**4.5**	**2,3**
	Memory Management: basic memory definition, dynamic allocation, problems of dynamic allocation, swapping, fragmentation, segmentation, paging, structure of page tables, System architecture	**2**	**6**	**1,2**
	Virtual Memory: basic VM concept, demand paging, COW, page replacement algos, FIFO, optimal, LRU, second chance, frame allocation, thrashing, kernel memory, buddy, slab allocation.	**2**	**6**	**1,2**
	Process Synchronization: concurrency, race condition, critical section, Peterson solution, test and set instruction, mutex, semaphore. Classical problems such as bounder buffer, reader writer, dinning philosopher.	**2**	**6**	**2,3**
	Deadlock: basic concept, detection, prevention, avoidance, banker's algorithm. protection and security of resources and processes.	**1**	**3**	**1,2**
	Security: security threats and attacks, fundamentals of encryption, authentication, and hashing, various countermeasures to security attacks	**1**	**3**	**1,2**
	Total	**15**	**45**	

Laboratory Projects/Experiments Done in the Course	**Lab 1:** Introduction to Linux & Basic Linux Commands
	Lab 2: Basic Linux Commands
	Lab 3: Shell Programming/Scripting
	Lab 4: Shell Programming/Scripting
	Lab 5: System Call related to Process Management
	Lab 6: Inter- Process Communication
	Lab 7: Kernel Configuration

	Lab 8: Mid Exam
	Lab 9: Multithread Programming in Pthreads
	Lab 10: Creating a module in Kernel
	Lab 11: Multithread Programming in OpenMP (shared memory)
	Lab 12: Semaphores in Linux
	Lab 13: Signals in Linux
	Lab 14: Revisions
	Lab 15: Final Lab Exam
Programming Assignments Done inthe Course	Programming assignment is given to students.

Class Time Spent on (In credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	20	30	40	10

Oral and Written Communications	Every student is required to submit a project along with its report of not more than 8pages.

Instructor Name: ANAUM HAMID

Instructor Signature

Date 31st, January 2022