A. Course Handout (Version 1.0)

Institute/School Name	Chitkara University Institute of Engineering and Technology		
Department Name	Department of Computer Science & Engineering		
Programme Name	Bachelor of Engineering (B.E.), Computer Science & Engineering		
Course Name	System Design	Session	2024-2025
Course Code	22CS024	Semester/ Batch	5th/2022
L-T-P (Per Week)	2-0-0	Course Credits	2
Course Coordinator	Dr. Rajdavinder Singh Boparai		

CLO01	To understand the role of an operating system and database management system in system design based on their structures, services and functionalities.
CLO02	To provide students with a comprehensive understanding of process management, scheduling strategies, race condition prevention, and multithreading concepts, preparing them to apply these skills in practical scenarios and system design.
CLO03	To equip students with the knowledge and skills necessary to understand, implement, and optimize memory management techniques such as contiguous allocation, paging, segmentation, page replacement and implementation of file systems.
CLO04	To provide students with a comprehensive understanding of advanced topics in operating system security, synchronization mechanisms, cache memory management, and deadlock handling.
CLO05	To provide students with a solid understanding of database management systems, SQL and NoSQL databases, SQL query languages, and database design principles such as functional dependency and normalization.

1. Objectives of the Course

Aim of this course is to provide students with a solid foundation of system design by understanding process management, memory management, concurrency control, file systems, security principles, and database management. Key objectives of the course are as follows:

- Understand operating system fundamentals including process, process creation, termination, and scheduling techniques.
- To explore the fundamentals of threads and multithreading, contiguous memory allocation, paging, segmentation, and their respective roles in efficient memory management.
- To introduce the concepts of file systems and provide comprehensive knowledge on deadlock prevention, avoidance, detection, and recovery strategies.
- To discuss the importance of cache memory and cache replacement policies in optimizing system performance and also to teach principles of access control, authentication, and secure operating system design to mitigate security threats and malware.
- Introduce students to the fundamentals of database management systems and further to focus on database design by applying the database design principles and SQL query techniques to model and manipulate relational data effectively.

2. Course Learning Outcomes

After completion of the course, student should be able to:

	Course Learning Outcome	*POs	**CL	***KC	Sessions
CLO01	To understand the role of an operating system and database management system in system design based on their structures, services and functionalities.	PO1, PO2, PO3, PO4, PO5, PO10, PO11, PO12	K2	Understanding	**3**
CLO02	To provide students with a comprehensive understanding of process management, scheduling strategies, race condition prevention, and multithreading concepts, preparing them to apply these skills in practical scenarios and system design.	PO1, PO2, PO3, PO4, PO5, PO10, PO11, PO12	K2 K3	Understanding and Applying	**5**
CLO03	To equip students with the knowledge and skills necessary to understand, implement, and optimize memory management techniques such as contiguous allocation, paging, segmentation, page replacement and implementation of file systems.	PO1, PO2, PO3, PO4, PO5, PO10, PO11, PO12	K2 K3	Understanding and Applying	**5**
CLO04	To provide students with a comprehensive understanding of advanced topics in operating system security, synchronization mechanisms, cache memory management, and deadlock handling.	PO1, PO2, PO3, PO4, PO5, PO10, PO11, PO12	K2	Understanding	**7**
CLO05	To provide students with a solid understanding of database management systems, SQL and NoSQL databases, SQL query languages, and database design principles such as functional dependency and normalization.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8 PO10, PO11, PO12	K2 K3	Understanding and Applying	**10**
Total Contact Hours					**30**

Revised Bloom's Taxonomy Terminology

* PO's available at (shorturl.at/cryzF)

**Cognitive Level =CL

***Knowledge Categories = KC

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO01	H	H	H	L	H					H	H	H
CLO02	H	H	H	L	H					H	H	H
CLO03	H	H	H	L	H					H	H	H
CLO04	H	H	H	L	H					H	H	H
CLO05	H	H	H	M	H	M	M	H		H	H	H

H=High, M=Medium, L=Low

3. ERISE Grid Mapping

Feature Enablement	Level (1-5, 5 being highest)
Entrepreneurship	5
Research	4
Innovation	4
Skills	4
Employability	5

4. Recommended Books:

Text Books:

B01: Operating System Concepts Essentials by Avi Silberschatz, Peter Galvin, Greg Gagne.
B02: Modern Operating Systems by Tanenbaum, Andrew S.
B03: Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan.
B04: Fundamentals of Database Systems by Ramez Elmasri, Shamkant B. Navathe.

Reference Books:

B05: Systems Analysis and Design by Gary Shelly, Harry J. Rosenblatt.
B06: System Analysis and Design by Julie E Kendall and Kenneth E Kendal.

E-Resources:

https://www.tutorialspoint.com/operating_system/index.htm
https://onlinecourses.nptel.ac.in/noc19_cs46/preview

5. Other readings and relevant websites:

Serial No	Link of Journals, Magazines, websites and Research Papers
1.	https://dl.acm.org/doi/abs/10.5555/540365
2.	https://dl.acm.org/doi/abs/10.5555/3526
3.	https://dl.acm.org/doi/abs/10.5555/95329
4.	https://books.google.co.in/books?hl=en&lr=&id=FTUJNA4lLdAC&oi=fnd&pg=PR1&dq=database+management+system+dbms&ots=TXKs17WTr6&sig=dEVh74XH3Ho4_ewmwI9P6cEo7_Q&redir_esc=y#v=onepage&q=database%20management%20system%20dbms&f=false
5.	https://dl.acm.org/doi/abs/10.5555/1074100.1074317
6.	https://www.jerrypost.com/database/Chapters/DBMSPost-Contents-601.pdf

6. Recommended Tools and Platforms

- Oracle, MSSQL Server, MySQL, Linux.
- W3Schools (https://www.w3schools.com/sql/sql_intro.asp)
- Coursera (https://www.coursera.org/learn/linux-and-sql)

7. Course Plan:

Lecture Number	Topics	Text Book
1	**Detail Discussion of Course Handout (CHO).**	
2-3	**Basics of Operating Systems:** Introduction and Types of Operating Systems, Process Creation and Termination, Pre-emptive Scheduling Techniques.	BO1 and BO2
4-5	**Process Scheduling:** Non-preemptive Scheduling Techniques, Race Conditions.	BO1 and BO2
6-7	**Thread and Multithreading:** Basics of Threads, Multithreading.	BO1 and BO2
8-9	**Memory Management:** Contiguous Memory Allocation, Paging, Segmentation.	BO1 and BO2
10-11	**Virtual Memory:** Thrashing and Page Faults, Page Replacement Algorithms.	BO1 and BO2
12	**File Systems:** Introduction to File Systems, File System Implementation.	BO1 and BO2
13-16	**Concurrency and Synchronization:** Deadlocks: Prevention, Avoidance, Detection, and Recovery, Semaphores and Mutexes, Monitors and Condition Variables.	BO1 and BO2
ST-1 Syllabus (Lecture number 1-16)		
17-18	**Advanced Memory Management:** Cache Memory and Cache Replacement Policies.	BO1 and BO2
19-20	**Operating Systems Security:** Access Control and Authentication, Secure OS Design and Implementation, Malware and Defense Mechanisms.	BO1 and BO2

21-22	Introduction to DBMS and RDBMS, SQL vs NoSQL.	BO3 and BO4
23-25	SQL Queries: DDL, DML and DCL.	BO3 and BO4
26-27	SQL Queries: TCL and DQL.	BO3 and BO4
28-30	Functional Dependency, Normalization and Normal Forms.	BO3 and BO4
ST-3 Syllabus (Lecture number 17-30)		
ETE (Syllabus = (Lecture number 1-30)		

8. Delivery/Instructional Resources

Lecture No.	Topics	Web References	Audio-Video
1	**Detail Discussion of Course Handout (CHO).**		
2-3	**Basics of Operating Systems:** Introduction and Types of Operating Systems, Process Creation and Termination, Pre-emptive Scheduling Techniques.	https://www.geeksforgeeks.org/operating-systems/ https://www.tutorialspoint.com/operating_system/index.htm	https://www.youtube.com/playlist?list=PLuuQCKO44unuHrC5MrjUjcVOv2iaQSKfi
4-5	**Process Scheduling:** Non-preemptive Scheduling Techniques, Race Conditions.	https://www.geeksforgeeks.org/operating-systems/ https://www.tutorialspoint.com/operating_system/index.htm	https://www.youtube.com/playlist?list=PLuuQCKO44unuHrC5MrjUjcVOv2iaQSKfi
6-7	**Thread and Multithreading:** Basics of Threads, Multithreading.	https://www.geeksforgeeks.org/operating-systems/ https://www.tutorialspoint.com/operating_system/index.htm	https://www.youtube.com/playlist?list=PLuuQCKO44unuHrC5MrjUjcVOv2iaQSKfi
8-9	**Memory Management:** Contiguous Memory Allocation, Paging, Segmentation.	https://www.geeksforgeeks.org/operating-systems/ https://www.tutorialspoint.com/operating_system/index.htm	https://www.youtube.com/playlist?list=PLuuQCKO44unuHrC5MrjUjcVOv2iaQSKfi
10-11	**Virtual Memory:** Thrashing and Page Faults, Page Replacement Algorithms.	https://www.geeksforgeeks.org/operating-systems/ https://www.tutorialspoint.com/operating_system/index.htm	https://www.youtube.com/playlist?list=PLuuQCKO44unuHrC5MrjUjcVOv2iaQSKfi

12	**File Systems:** Introduction to File Systems, File System Implementation.	https://www.geeksforgeeks.org/operating-systems/ https://www.tutorialspoint.com/operating_system/index.htm	https://www.youtube.com/playlist?list=PLuuQCKO44unuHrC5MrjUjcVOv2iaQSKfi
13-16	**Concurrency and Synchronization:** Deadlocks: Prevention, Avoidance, Detection, and Recovery, Semaphores and Mutexes, Monitors and Condition Variables.	https://www.geeksforgeeks.org/operating-systems/ https://www.tutorialspoint.com/operating_system/index.htm	https://www.youtube.com/playlist?list=PLuuQCKO44unuHrC5MrjUjcVOv2iaQSKfi
17-18	**Advanced Memory Management:** Cache Memory and Cache Replacement Policies**.**	https://www.geeksforgeeks.org/operating-systems/ https://www.tutorialspoint.com/operating_system/index.htm	https://www.youtube.com/playlist?list=PLuuQCKO44unuHrC5MrjUjcVOv2iaQSKfi
19-20	**Operating Systems Security:** Access Control and Authentication, Secure OS Design and Implementation, Malware and Defense Mechanisms.	https://www.geeksforgeeks.org/operating-systems/ https://www.tutorialspoint.com/operating_system/index.htm	https://www.youtube.com/playlist?list=PLuuQCKO44unuHrC5MrjUjcVOv2iaQSKfi
21-22	**Introduction to DBMS and RDBMS, SQL vs NoSQL.**	https://www.scaler.com/topics/course/dbms/ https://onlinecourses.nptel.ac.in/noc19_cs46/preview	https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
23-25	**SQL Queries: DDL, DML and DCL.**	https://www.scaler.com/topics/course/dbms/ https://onlinecourses.nptel.ac.in/noc19_cs46/preview	https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
26-27	**SQL Queries: TCL and DQL.**	https://www.scaler.com/topics/course/dbms/ https://onlinecourses.nptel.ac.in/noc19_cs46/preview	https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
28-30	**Functional Dependency, Normalization and Normal Forms.**	https://www.scaler.com/topics/course/dbms/ https://onlinecourses.nptel.ac.in/noc19_cs46/preview	https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh

9. Action plan for different types of learners

Slow Learners	Average Learners	Fast Learners
• Remedial classes • Detailed notes • Encouragement for improvement using Peer Tutoring	• Workshops • Formative Exercises used to highlight concepts and notions • Course certifications	• Design solutions for complex problems • Presentation on topics beyond those covered in CHO • Course certifications • Project based learning

10. Evaluation Scheme & Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment
Component 2	Subjective Test/Sessional Tests (STs)	02*	40%	Online on-campus
Component 3	End Term Examinations	01**	60%	Online on-campus
Total		**100%**		

*Best 1 Sessional Test will be counted for final assessment.
**As per Academic Guidelines, a minimum of 75% attendance is required to appear for the End Term Examination.

11. Syllabus of the Course:

Subject: System Design / 22CS024			
S. No.	**Topic (s)**	**No. of Sessions**	**Weightage %**
1	**Detail Discussion of Course Handout (CHO).** **Basics of Operating Systems:** Introduction and Types of Operating Systems, Process Creation and Termination, Pre-emptive Scheduling Techniques. **Process Scheduling:** Non-preemptive Scheduling Techniques, Race Conditions. **Thread and Multithreading:** Basics of Threads, Multithreading. **Memory Management:**	**16**	**50%**

	Contiguous Memory Allocation, Paging, Segmentation. **Virtual Memory:** Thrashing and Page Faults, Page Replacement Algorithms. **File Systems:** Introduction to File Systems, File System Implementation. **Concurrency and Synchronization:** Deadlocks: Prevention, Avoidance, Detection, and Recovery, Semaphores and Mutexes, Monitors and Condition Variables.		
ST-1 (Covering 50% syllabus)			
2	**Advanced Memory Management:** Cache Memory and Cache Replacement Policies**.** **Operating Systems Security:** Access Control and Authentication, Secure OS Design and Implementation, Malware and Defense Mechanisms. **Introduction to DBMS and RDBMS, SQL vs NoSQL.** **SQL Queries: DDL, DML and DCL.** **SQL Queries: TCL and DQL.** **Functional Dependency, Normalization and Normal Forms.**	**14**	**50%**
ST-2 (Covering 50% syllabus)			
End Term 100% syllabus (Covering 100% syllabus)			

This Document is approved by:

Designation	**Name**	**Signature**
Course Coordinator	Dr. Rajdavinder Singh Boparai	
Head-Academic Delivery	Dr. Susheela Hooda	
Dean	Dr. Rupali Gill	
Dean Academics	Dr. Monit Kapoor	
Date	11th July, 2024	