

Institute/ School Name	School of Engineering and Technology		
Department Name	Department of Computer Science & Engineering		
Program Name	Bachelor of Engineering (Computer Science and Engineering): B.E (CSE)		
Course Code	25CS023	Course Name	Professional Practices-System Design
L-T-P (Per Week)	2-0-0	Course Credits	02
Academic Year	2025-26	Semester/Batch	5 th /2023-27
Course Coordinator	Dr. Rani Kumari		

1. Course Outline:

Operating System—Types, Process Management, Process Scheduling, Threads, Process Synchronization, Race Condition, Deadlock, Memory Management, Virtual Memory, File System, DBMS – RDBMS, SQL vs. NoSQL, SQL Queries, Functional Dependency and Normalization, Indexing Tabular and Columnar Data, CAP Theorem, Network – OSI Model, Network Layer, IP Addressing and Subnetting, System Design – HLD, LLD, REST APIs, SOLID Principles, Case Study

2. Programme Outcomes (POs):

At the end of the programme, students will be able to achieve knowledge about the following:

PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

3. Course Learning Outcomes (CLO):

After completing the course, the students will be able to:

CLO1: Understand basic concepts related to processes, threads, process scheduling, race conditions, critical sections, and file systems to build strong technical and system-level skills.

CLO2: Describe various memory management techniques, including paging, segmentation, virtual memory, and thrashing, to strengthen problem-solving and systems analysis skills.

CLO3: Demonstrate knowledge of the OSI layers and implement IP addressing and subnet masking, fostering networking skills and supporting entrepreneurial initiatives.

CLO4: Apply DBMS queries effectively to support research, data management innovation, and decision-making processes.

CLO5: Develop high-level design (HLD) and low-level design (LLD) for software solutions to enhance entrepreneurship and improve employability in software development roles.

4. CLO-PO Mapping Matrix:

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1		H	M		L						M	
CLO2	M	M	H	L	M							M
CLO3				L								
CLO4			L	L	M							M
CLO5			H	L	M							M

5. ERISE Grid Mapping:

Feature Enablement	Level (1-5, 5 being highest)
Entrepreneurship	1
Research/Innovation	2
Skills	4
Employability	3

6. Recommended Books (Reference Books/Text Books):

B01: Silberschatz, A., Galvin, P. B., & Gagne, G. (8th Edition). Operating system concepts with Java. Wiley Publishing.

B02: Elmasri, R., & Navathe, S. B. (6th Edition). Database systems: Models, languages, design, and application programming. Pearson Education India.

B03: Forouzan, B. A. (4th Edition). Data communications and networking. Huga Media.

B04: Dennis, A., Wixom, B. H., & Roth, R. M. (5th Edition). Systems analysis and design. John Wiley & Sons.

7. Other readings and relevant websites:

Resources	Link of Journals, Magazines, Websites and Research Papers
R1	https://www.researchgate.net/publication/372132620_OPERATING_SYSTEM
R2	https://www.imperva.com/learn/application-security/osi-model/
R3	https://dl.acm.org/journal/dbms
R4	https://medium.com/coders-mojo/day-1-of-system-design-case-studies-series-b3c3fecae079

Resources	Link of Audio-Video resources
V1	https://www.youtube.com/watch?v=mXw9ruZaxzQ
V2	https://www.youtube.com/watch?v=q3Z3Qa1UNBA
V3	https://www.youtube.com/watch?v=sEaYXwmsLw0&list=PLyqSpQzTE6M-xymXgqewlzcC3U4cdRoSu

* Resources uploaded on CQ-LMS is accessible to all the students registered for the course.

8. Recommended Tools and Platforms:

- a. **MySQL** – For practicing SQL queries and understanding relational databases
- b. **Draw.io / Lucidchart** – For creating HLD and LLD diagrams (Class, Sequence, Activity, etc.)
- c. **Postman** – For testing REST APIs and understanding HTTP methods
- d. **Wireshark** – For analyzing network packets (useful for OSI and IP layer understanding)
- e. **Online Platform** – <https://testpad.chitkarauniversity.edu.in> for internal assessments and assignments

9. Course Plan:

Lecture Number	Topics	Weightage in ETE (%)	Instructional Resources
1	Basics and Types of Operating Systems	25	B01, R1, V1
2	Process Management and Process Lifecycle		
3	Process Scheduling: Pre-emptive and Non-preemptive Algorithms		
4	Threading and Multithreading Concepts		
5	Process Synchronization: Semaphores and Monitors		
6	Race Conditions and Critical Section Problem		
7	Deadlock: Detection, Avoidance, and Prevention		
8	Memory Management: Paging and Segmentation		
9	Virtual Memory: Page Replacement Algorithms and Thrashing		
10	File System Overview in Operating Systems	25	B02, R2, V3
11	Introduction to DBMS and RDBMS		
12	SQL vs NoSQL Databases		
13	SQL Queries and Joins		
14	Functional Dependency and Normalization (1NF to BCNF)		
15	Indexing: Tabular vs Columnar Data		
16	ACID vs BASE Properties		
17	CAP Theorem and Trade-offs in Distributed Systems	25	B03, R3, V2
18	OSI Model and Layer-wise Functions		
19	IP Addressing, CIDR, and Subnetting		
20	Introduction to REST APIs and HTTP/HTTPS Protocols		
21	Load Balancing, Caching, and CDN Overview		
22	Introduction to High-Level Design (HLD): Functional & Non-functional Requirements		
23	Platform, Technology, and Architecture Choice		
24	Scalability, Availability, and Fault Tolerance in Design		

25	HLD Case Study: Chat Application Design	25	B04, V2, R3, R4
26	Low-Level Design (LLD): Class, Sequence, Activity Diagrams		
27	LLD: Aggregation, Composition, Generalization, Dependency		
28	LLD Principles: SOLID and Object-Oriented Design Patterns		
29	Case Study: E-Commerce Checkout or URL Shortener		
30	Scaling Strategies: SQL vs NoSQL, Sharding and Replication		

10. Industry Interventions:

- Industry Curated Module: <https://testpad.chitkarauniversity.edu.in>

11. Action plan for different types of learners

Slow Learners	Average Learners	Advanced Learners
Remedial Classes	Workshops / Practice Assignment*	Advanced Problems*

* The practice test will be assigned on the LMS platform for both average and advanced learners.

12. Evaluation Scheme & Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment (Offline/ Online)
Internal Component 1	Formative Assessments (FAs)	03*	10%	Online **
Internal Component 2	Sessional Tests (STs)	02**	30%	Online ***
External Component	End Term Examination (ETE)	01	60%	Online ***
Total		100%		

* Out of the three, the best two will be considered to evaluate final marks.

** Out of the two STs, the best one will be considered.

*** Proctored examination will be conducted on Testpad platform.

13. Details of Evaluation Components:

Evaluation Component	Description	Syllabus Covered (%)	Timeline of Examination	Weightage (%)
Internal Component 1	FA1	Up to 30% (Lectures 1-6)	Week 5	10%
	FA2	31%-60% (Lectures 7-12)	Week 8	
	FA3	61%-90% (Lectures 13-18)	Week 13	
Internal Component 2	ST 01	Up to 40 (Lectures 1-12)	Week 11	30%
	ST 02	41% - 80% (Lectures 13-24)	Week 17	
External Component	End Term Examination*	100%	As Notified by the Exam Cell	60%
Total				100%

*Minimum 75% attendance is required to become eligible for appearing in the End Term Examination.

14. Format of Evaluation Components:

Type of Assessment	Total Marks	1 Mark MCQ	2 Marks MCQ
Formative Assessment	40	40	-
Sessional Tests	40	20	10
End Term Examination	60	30	15

15. Revision (if any):

Academic Year of Previous Version	2024-2025	Percentage of Revision	15%
Topics Added:			
<ul style="list-style-type: none">• Process Synchronization: Semaphores and Monitors• Deadlock: Detection, Avoidance, and Prevention• CAP Theorem and Trade-offs in Distributed Systems• REST APIs and HTTP/HTTPS Protocols• SOLID Principles and OO Design Patterns			
Topics Deleted:			
<ul style="list-style-type: none">• Classful Addressing• Subnet Mask and Creation of Subnets (merged under IP Addressing)• CricInfo Website Case Study (replaced with more relevant case study)			

16. This Document is:

Designation	Name	Signature
Prepared by Course Coordinator	Dr. Rani Kumari	
Verified by Assistant Dean	Dr. Ashutosh Kumar Dubey Ms. Ravita Chahar	
Approved by Pro VC	Prof. (Dr.) Meenu Khurana	
Date	23 rd June 2025	