# Aliah University

**Odd Semester Examination (Autumn Semester) 2025-26**

**(For 3rd year 5th Semester B. Tech)**

**Paper Name: Database Management Systems** **Full Marks: 80**

**Paper Code: CSEUGPC11** **Time: 3 hours**

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**Group A (Answer all the questions)** **5X2=10**

1. What is weak entity? How is it represented in ER diagram? *[CO-1, Remembering]*
2. What is lossless join property of decomposition? *[CO-4, Understanding]*
3. Define a) composite attribute b) super key. *[CO-2, Remembering]*
4. When are two schedules said to be conflict equivalent? *[CO-5, Understanding]*
5. Differentiate File systems and Database Management System. *[CO-6, Understanding]*

**Group B (Answer any five questions)** **5X6=30**

1. What are integrity constraints? Define the terms primary key constraint and foreign-key constraint. How are these constraints expressed in SQL? *[CO-3, Understanding]* [1+3+2]
2. Draw and explain three level architecture of database system. Compare DDL and DML with the help of an example. *[CO-1, Understanding]* [3+3]
3. Differentiate: a) Sparse and Dense index b) Logical and Physical Data Independence. *[CO-6, Understanding]* [3+3]
4. Explain about the following clauses with example queries. (a) Group by (b) Order by (c) Aggregation functions. *[CO-3, Understanding]* [3x2]
5. Compute the closure of the following set F of FDs for the relation schema R = (A, B, C, D, E), A->BC, CD->E, B->D, E->A. List the candidate keys for R? *[CO-4, Analyzing]* [4+2]
6. Explain about immediate update and deferred update recovery techniques. *[CO-5, Understanding]* [3+3]

**Group C (Answer any four questions)** **4X10=40**

1. a) Define relationship. Give an example.
b) Explain briefly cardinality ratio constraint of Relationships through examples.
c) What is participation constraint? Give examples.
d) Explain with an example the concept of unary relationship. *[CO-2, Understanding]*
[2+3+3+2]

2. Consider the following relations for a database that keeps track of business trips of salespersons in a sales office:
SALESPERSON (Ssn, Name, StartYear, DeptNo)
TRIP (Ssn, FromCity, ToCity, DepartureDate, ReturnDate, TripId)
EXPENSE (TripId, AccountNo, Amount)
a) A trip can be charged to one or more accounts. Specify the foreign keys for this schema, stating any assumptions you make.
b) Write relational algebra expression to get the details of salesperson who have travelled between Mumbai and Delhi and the travel expense is greater than Rs 50000.
c)Write relational algebra expression to get the details of salesperson who had incurred the greatest travel expenses among all travels made. *[CO-3, Evaluating]* [2+4+4]

3.a) Is BCNF stronger than 3NF? Justify your answer.

b) What is functional dependency? Explain its use in database design.

c) Normalize following relation up to 3NF: Bank (acno, cust_name, ac_type, bal, int_rate, cust_city, branchId, branch_nm, br_city) *[CO-4,Analyzing]*
[3+3+4]

4. a) Discuss about conflict Serializability with an example.

b) What is 2-phase locking protocol?

c) Compare 2PL with Strict 2PL protocol. *[CO-6, Understanding]* [4+3+3]

5. Explain the following terms: *[CO-3,Understanding]* [2.5 X 4]

a) Log based recovery

b) ACID properties

c) Recoverability

d)Specialization

# Aliah University

Odd (Autumn)-Semester Examination - 2025

(For 5th Semester BTech(CSE) Programme)

**Paper Name:** Formal Languages and Automata Theory **Full Marks:** 80

**Paper Code:** CSEUGPC13 **Time:** 3 Hrs

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Group – A (5X2=10)

1. Give a one-sentence answer – Apply, CO1-CO5

   a) What is the difference between DFA and NFA?

   b) What is minimization of finite automata?

   c) What is Chomsky Normal Form (CNF)?

   d) What is an ambiguous grammar?

   e) Define a Turing Machine (TM).

Group – B

(Answer any six questions) (6X5=30)

2. Define ambiguity in CFG and explain with example. **Understand, CO3**

3. Minimize the DFA for the language L = All strings over Σ = {a, b} where each string ends with "bbaa". **Apply, CO2**

4. Draw a DFA over Σ = {0,1} where each string is divisible by 5. **Apply, CO2**

5. Draw a DFA over Σ = {0,1} which will accept all strings having even number of 0 and odd number of 1. **Apply, CO2**

6. Construct a Pushdown Automata (PDA) for the language L = {0^n1^n | n ≥ 0}. **Apply, CO3**

7. Convert the following grammar to Chomsky Normal Form (CNF): **Apply, CO3**
   S → CD | ε
   C → cC | c
   D → dD | d

8. Given the NFA with states {q0, q1}, alphabet {a, b}, and transitions δ(q0, a) = {q0, q1}, δ(q0, b) = {q0}, δ(q1, a) = {q1}, δ(q1, b) = ∅. Convert this NFA to a DFA. **Apply, CO2**

## Group – C

(Answer any four questions) (10X4=40)

**9.**

a) Construct a CFG for palindromes over {0,1}. **5** **Apply, CO3**

b) Simplify the following Context-Free Grammar:

$S \rightarrow AB \mid AC$

$A \rightarrow aA \mid a$

$B \rightarrow bB \mid b$

$C \rightarrow cC \mid c$ **5** **Apply, CO2**

**10.** a) Discuss the Chomsky Normal Form (CNF) for context-free grammars.

**5** **Understand, CO3**

b) Draw the parse tree for the string "aabb" using the grammar $S \rightarrow aSb \mid ab$.

**5** **Apply, CO3**

**11.** a) Define leftmost and rightmost derivations in context-free grammars.

**4** **Remember CO3**

b) Show both derivations for the string "aabb" using the CFG: $S \rightarrow aSb \mid \varepsilon$

**6** **Apply, CO3**

**12.** Write short notes on the following: **5+5** **Understand, CO1**

a) Chomsky Hierarchy of Languages

b) Closure Properties of Regular Languages

**13.**

a) Construct a regular grammar for all strings over {a,b} that start with a and end with b.

b) Convert it into an equivalent DFA. **5+5** **Apply, CO2**

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# B.Tech. Examination-2025
## Electronics and Communication Engineering
## (Odd Semester Regular & Supplementary Examination)
## Microprocessor and Its Application (ECEUGOE04) (for CSE)

Full Marks: 80

Time: 3.00 Hrs

- *Answer question No. 1 and any Seven questions from the rest.*
- *Answer all parts of a question in same place.*
- *Figures on the right hand side margin indicate full marks.*
- *Symbols have their usual meaning*

| Q. No. | | Stem of the question | M |
|---|---|---|---|
| 1 | | **Answer any five from question No.1** | |
| | (a) | What are the features 8085 microprocessor? | 2 |
| | (b) | Write a program to set all flags of 8085 microprocessor without effecting the content of accumulator. | 2 |
| | (c) | What is a tristate logic? Why is it needed in a microprocessor system? | 2 |
| | (d) | How are the address and data bus demultiplexed in 8085 microprocessor? | 2 |
| | (e) | Why is address bus unidirectional? | 2 |
| | (f) | What is program counter? How is it useful in program execution? | 2 |
| | (g) | Calculate the vector location of RST 7.5 interrupt of 8085 microprocessor. | 2 |
| 2 | | What is microprocessor? Sketch and explain the various pins of the 8085 microprocessor. | 10 |
| 3 | (a) | Draw the timing diagram of INR B (Opcode: 2C) instruction stored in memory location 8000H. | 5 |
| | (b) | Write a program to generate a 1sec time delay considering the operating frequency of 8085 is 4MHz. | 5 |
| 4 | (a) | What is interrupt? Explain different types of interrupts. Write a program to enable all interrupt except RST 5.5 | 5 |
| | (b) | Differentiate between memory mapped I/O and peripheral mapped I/O or I/O mapped I/O. | 5 |
| 5 | (a) | Can the same port address be assigned to two I/O devices if interfaced in peripheral mapped I/O? If yes, how and if no, Why? | 5 |
| | (b) | Write down the function of the following instructions<br>a) STAX b) SHLD c) DAA d) LXI e) CMP | 5 |
| 6 | | Eight BCD numbers are stored in consecutive memory locations starting from 8500H. Write a program to add them and store the result in 8600H and 8601H. | 10 |
| 7 | (a) | Explain the function of memory point registrar SP and PC and why are they 16-bit registrars? | 5 |
| | (b) | Interface the 4KB RAM, and 4KB EPROM memory devices in 8085 microprocessor in absolute decoding method. | 5 |

| | | | |
|---|---|---|---|
| 8 | (a) | CALL and RET are the only instructions of 8085 that uses subroutine. Comment on this statement. | 5 |
| | (b) | Design a seven-segment LED output port with the device address F5H, using a 3-to-8 decoder, 4 input NAND gate, NOR gate and a common anode seven segment LED. Write program to display digit 7 at the port. | 5 |
| 9 | (a) | Draw and explain the functional block diagram of 8255. | 5 |
| | (b) | Draw and explain the control word format of 8255. Write a control word for port A and port C as an input port and port B as an output port. | 5 |
| 10 | (a) | What are the functional units available in 8086 architecture? Discuss in brief of 8086 architecture. | 5 |
| | (b) | What is queue? How queue is implemented in 8086 microprocessor. | 5 |
| 11 | (a) | Explain how 20-bit physical address is generated in 8086 microprocessor? | 5 |
| | (b) | Explain the process of segmentation of memory in 8086 microprocessor. What are its advantages? | 5 |

**Aliah University**

**Odd-Semester Examination (Autumn Semester) – 2025-26**

**(3rd Year, 5th SEM CSE)**

**Paper Name: Operating Systems** **Paper Code: CSEUGPC10**

**Full Marks: 80** **Time: 3 Hrs**

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***(General Instructions: Answers should be brief and to the point. Mention the Section name before answering it and each Section should be start from a new page and club together)***

## Section – A

**Answer all the questions:** **(10 x 1=10)**

| Sl. No. | Questions | Marks | CO | BT Level |
|---|---|---|---|---|
| 1. | What is real-time system? | 1 | 1 | Understand |
| 2. | What is scheduler? | 1 | 2 | Remember |
| 3. | What is independent process? | 1 | 2 | Understand |
| 4. | What is the use of IPC? | 1 | 3 | Understand |
| 5. | What is dispatch latency? | 1 | 4 | Remember |
| 6. | **Identify the two steps of a process execution.** a) I/O and CPU burst b) I/O and Memory burst c) Memory and CPU burst d) All the above | 1 | 3 | Remember |
| 7. | **A process which is copied from main memory to secondary memory on the basis of requirement is known as** a) Paging b)Demand Paging c) Segmentation d) Option (b) and (c) | 1 | 6 | Remember |
| 8. | **Which of the following is also known as the base register?** a) Regular register b) Relocation register c) basic register d) All the above | 1 | 6 | Understand |
| 9. | **Unsafe states are -** a) Deadlocks b) Not deadlocks c) Livelock d) Software Lock | 1 | 5 | Understand |
| 10. | **The two types of semaphores are-** a) Counting and binary b) Counting and decimal c) Counting and mutex d) None | 1 | 4 | Understand |

## Section – B

**(Answer any 5 questions)** **(6 x 5=30)**

| Sl. No. | Questions | Marks | CO | BT Level |
|---|---|---|---|---|
| 1. a) | What is Multiprogramming Systems? Mention two advantages of it. | (1+2)+ | 1 | Remember, |
| b) | Differentiate between time-sharing and real time systems. Define interrupt and its type. | (2+1) | | Understand |
| 2. a) | What is process? Differentiate between process and program with a proper explanation. | (1+2)+ 3 | 2 | Remember, understand |
| b) | Explain lifecycle of a process with a suitable diagram. | | | |
| 3. a) | Define critical section. | 2+4 | 4 | Remember, |
| b) | What are the requirements for a solution of a CS problem? | | | Understand |
| 4. a) | Consider the following table and find out **i) average waiting time ii) average turnaround time** for RR CPU scheduling algorithms. Assume time slice= 4 ms<br>Process Arrival Time Burst Time<br>P1 0 9<br>P2 1 6<br>P3 2 3<br>P4 3 4 | 4 +2 | 3 | Apply, Understand |
| b) | Define preemptive and non-preemptive scheduling algorithm. | | | |

| | | | | |
|---|---|---|---|---|
| 5. a)<br>b) | **Explain the various steps of address binding method.**<br>**Differentiate first fit, worst fit and best fit methods in terms of allocation.** | 4+2 | 6 | Understand, Remember |
| 6. a) | A computer system has a logical address space of **32 KB** and a physical address space of **128 KB**. If the page size is **2 KB**, determine:<br>i) Number of bits in the **logical address**<br>ii) Number of bits in the **physical address**<br>iii) Number of **offset bits** | 6 | 6 | Apply |
| 7. a)<br><br><br><br>b) | In a system with paging, the following parameters are provided:<br>**Memory access time (Tm):** 200 ns<br>**Page table access time (Tp):** 50 ns<br>The system uses a **TLB (Translation Look aside Buffer)** with a hit ratio of 80%.<br>Find the **Effective Memory Access Time (EMAT)** for the given system.<br><br>What is virtual memory? | 5+1 | 6 | Apply, Remember |

Section – C

(Answer any 4 questions) (10 x 4=40)

| Sl No. | Questions | Marks | CO | BT Level |
|---|---|---|---|---|
| 1. a)<br>b)<br>c) | What is paging? Explain the paging methods with a suitable diagram.<br>What are advantages of TLB with paging over paging technique?<br>What is demand paging? | 7+2+1 | 6 | Understand, Remember |
| 2. a)<br>b)<br>c) | Explain various necessary conditions for a deadlock to occur.<br>What is RAG? Explain with an example.<br>"If there is a cycle in a RAG, then the system may or may not be in a deadlocked state". Justify the statement. | 4+2+4 | 5 | Remember, understand |
| 3. | What is the need of Page replacement? Consider the following reference string 4, 0, 1, 2, 7, 4, 0, 1, 3, 0, 4, 0, 1, 2, 7, 3, 2, 4, 0,1, 2, 7<br>Find the number of Page Faults with FIFO, Optimal Page replacement and LRU with **Three** free frames which are empty initially. Which algorithm gives the minimum number of page faults? | 10 | 5 | Apply |
| 4. a)<br><br><br><br>b) | A computer system is recording real-time audio at a very high speed. The continuous stream of audio samples must be stored in main memory without losing data.<br>Which method is required in this situation? How does the method improve system performance compared to CPU-controlled I/O?<br><br>A system implements the classic **Producer–Consumer problem** using a shared bounded buffer of size **N**. Both the Producer and Consumer processes use the shared variables.<br>Explain how a **race condition** can occur in the above Producer–Consumer bounded buffer implementation. What problems will arise in the system because of these race conditions? | (1+4)<br>+(4+1) | 7,4 | Understand, Analyze, Apply |
| 5. a)<br>b) | Explain Peterson's solution for 2-process critical-section problem.<br>What is semaphore? Explain wait () and signal () operations. | 6+(1+3) | 4 | Remember, Understand |
| 6. | A disk has cylinders numbered from **0 to 199**. Current head position is **45 and** Requests are **72, 190, 15, 10, 150, 180, 100**, then what is the total number of head movements needed to satisfy these requests for the i) SCAN (head direction towards lower cylinders) and<br>ii) SSTF disk- scheduling algorithms? | 5+5 | 7 | Understand, Apply |

**End – Semester Examination (Autumn Semester) 2025 – 26**
**(For 3rd Year 5th Semester B.Tech)**

**Paper Name: Design and Analysis of Algorithms**
**Paper Code: CSEUGPC12**

**Full Marks: 80**
**Time: 3 Hrs**

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## Section – A

***Answer any five of the following*** ***5 x 2 = 10***

1. Write the recurrence relation for the time complexity of Merge Sort.
2. What is meant by optimal substructure?
3. Given the function: $f(n) = n \log n + 20n + 50$, prove that the worst-case time complexity is $O(n \log n)$.
4. How many distinct ways can parentheses be placed in a matrix chain of $n$ matrices to determine all possible multiplication orders in Matrix Chain Multiplication?
5. State the best-case time complexity of binary search.
6. Name two divide-and-conquer algorithms.
7. What is a spanning tree?

## Section – B

***Answer any five of the following*** ***5 x 6 = 30***

1. Determine the time complexity of the following code segment:

```
A () {
  int n = 2^(2^k);
  for (i = 1; i <= n; i++) {
    j = 2;
    while (j <= n) {
      j = j^2;
      printf ("MH");
    }}}
```

2. Arrange the following functions in increasing order of asymptotic growth as $n \to \infty$, and justify your answer:

$f_1(n) = n^{\log n}$,
$f_2(n) = 2^{\sqrt{n}}$,
$f_3(n) = n^{\log(\log n)}$,
$f_4(n) = (\log n)^{\log n}$.

Additionally, determine whether any two of these functions are asymptotically equivalent (i.e., Θ-equivalent).

3. Find the space complexity for the following code segment:

```
P(n) {
  if (n >= 1) {
    P(n - 1);
    printf(n);
    P(n - 1);
}}
```

4. Describe the dynamic programming algorithm to find the longest common subsequence between a pair of strings.
5. Solve the recurrence relation using the recursion tree method: $T(n) = 3T(n/4) + n$.

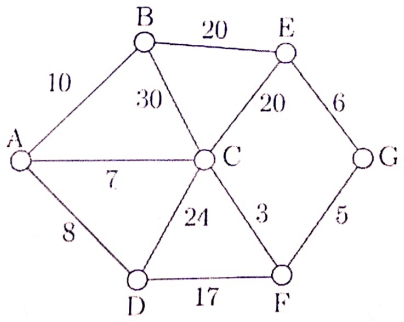
6. You are given six jobs with their deadlines and profits. Each job requires 1 unit of time to complete. Determine the sequence of jobs that maximizes total profit. **Jobs = *({JobID, Deadline, Profit}):***
***{(JobA, 3, 80), (JobB, 1, 60), (JobC, 2, 20), (JobD, 1, 90), (JobE, 3, 40), (JobF, 2, 70)}.***

7. Use the Master Method to determine the tight asymptotic bounds for the following recurrences:
   a) $T(n) = 4T(n/2) + n^2$
   b) $T(n) = 6T(n/3) + n^2 \log n$

## Section – C

***Answer any four of the following*** ***4 x 10 = 40***

1. Build a min-heap from the following list of keys and draw the heap after each insertion: **{12, 7, 15, 3, 9, 20, 1, 18, 6}**. After the heap is built, perform an **extract-min** operation and illustrate each step of the heap reconstruction (heapify) process. [5+5]
2. Derive the time complexity of the Quicksort algorithm by solving its recurrence relation using the back-substitution technique. Explain how the merge sort algorithm works using the divide-and-conquer approach. [5+5]
3. Compare and contrast divide-and-conquer and dynamic programming methods. Using the dynamic programming paradigm, find the Longest Common Subsequence (LCS) between the following sequences: ***X = {PQRSPQP}, Y = {QSRPQS}***. Construct the LCS table and list all possible LCSes of maximum length. [2 + 8]
4. The matrices **M1, M2, M3, M4** have the following dimensions: the following dimensions: **M1: 10×5, M2: 5×8, M3: 8×20, M4: 20×7**. Explain the dynamic programming method used to determine the optimal parenthesization of this matrix-chain multiplication. Compute the minimum number of scalar multiplications required. using Huffman encoding, compute the percentage improvement of **variable-length coding** over **fixed-length coding** for the characters ***a*** through ***f*** with the following frequencies: **a: 18, b: 7, c: 5, d: 20, e: 12, f: 9**. [5 + 5]
5. Using the weighted graph shown below, apply Kruskal's Algorithm to determine the Minimum Spanning Tree (MST). List the edges selected in the order they are added, and compute the total cost of the MST. Perform a **Depth-First Search (DFS) and Breadth-First Search (BFS)** traversals on the graph starting from vertex **'A'**. [4 + 2 + 2]




6. State the 0/1 Knapsack problem. Consider the following instance in which **P** represents the profit of each item, **W** represents the weight of each item, and **M** denotes the maximum capacity of the knapsack. Using dynamic programming, find the optimal 0/1 knapsack solution. **P: [20 50 60 90] W = [10 40 30 50] M: 50.** Also, determine the optimal total profit when **fractional items are allowed** (fractional knapsack). [2 + 5 + 3]