

2016

Time : 3 hours

Full Marks : 80

The questions are of equal value.

*Answer **all** questions.*

(INTRODUCTION TO OPERATING SYSTEM)

1. (a) Write the function of an operating system in managing the resources of a computer.
- (b) What is time Sharing Operating System ? Write its advantage over batch processing.

OR

- (c) What is an Interrupt ? Explain the use of I/O interrupts.
- (d) What is a Real Time System ? Distinguish between Soft and Hard real time systems.

2. (a) What is a file system ? Discuss on the file management services provided by an operating system.

(b) Explain how files are organized in a tree structure directory system.

OR

(c) How records are organized in a direct access file ? Explain the use of different hashing functions.

(d) Give a comparative view of different directory structures.

3. (a) Define process. Write the function of a process scheduler. Distinguish between Short-term and Long-term schedulers.

(b) Write the conditions for a deadlock. Explain how a resource allocation graph can be used to detect a deadlock state.

OR

(c) What is CPU/IO Burst Cycle ? Explain the need for CPU scheduling.

- (d) Compute the average turnaround time for the following workload using SJF technique :

Process	Next CPU burst	Arrival
ID	in ms	time
A	4	0
B	5	1
C	3	2
D	2	4

4. (a) Explain the paging technique for memory allocation. What is virtual memory ?
- (b) Compute the number of page faults for the following memory reference string using LRU technique (assume 3 frames per process).
- 1, 3, 5, 4, 2, 1, 4, 7, 4, 6, 4, 1, 2, 1, 7, 1.

OR

- (c) Distinguish between logical and physical address space. What is swapping ?
- (d) Explain dynamic memory allocation with multiple memory partitioning.



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**(COMPUTER ORGANIZATION AND
ARCHITECTURE)**

1. (a) What is a Microprocessor ? Explain the working of a 8-bit microprocessor.
- (b) What is meant by an Addressing Model ? Explain different type of addressing modes.

OR

- (c) Explain the use of machine language instructions in a computer.
- (d) What is a Timing Diagram ? Write its significance.

2. (a) What is meant by interfacing ? Explain the concept of memory interfacing.

(b) Explain different methods for interrupt handling.

OR

(c) Discuss the need for storage device interfacing. How is it achieved ?

(d) Explain different bus standards by highlighting their features.

3. (a) Distinguish between XOR and NOR gates with logic diagrams.

(b) Draw the Karnaugh map and simplify the following Boolean Expression :

$$Y(A, B, C) = \sum (0, 1, 3, 4, 5)$$

OR

(c) Realize an OR-AND network for the following Boolean function :

$$Y = (A + B) (C + D)$$

- (d) What is Boolean Algebra ? Write its significance in the design of logic circuits.
4. (a) Explain the working of a carry-look-ahead adder.
- (b) Distinguish between the function of a multiplexer and demultiplexer.

OR

- (c) Explain the working of Master-Slave flip-flop.
- (d) What are the combinational logic circuits ? Explain the function of Binary adder.



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(NUMERICAL ANALYSIS & STATISTICAL METHOD)

(MATH – II)

1. (a) Find out the negative root of the smallest magnitude of the equation

$$f(x) = 3x^3 + 10x^2 + 10x + 7 = 0$$

and perform two iterations of the bisection method.

- (b). Use the Newton-Raphson method to find the roots correct to three decimal places of the equation $x^4 - 3x^2 + x - 10 = 0$.

OR

- (c) Solve the following linear equation by using Gauss elimination method :

$$2x + y + 2z = 2$$

$$3x + 2y + z = 2$$

$$-x + y + 3z = 6$$

- (d) Perform five iterations of the bisection method to obtain the smallest positive root of the equation $f(x) = x^3 - 5x + 1 = 0$.

2. (a) Construct the divided difference table for the following data :

x	$f(x)$
0.5	1.625
1.5	5.875
3.0	31.0
5.0	131.0
6.5	282.125
8.0	521.0

Hence, find out the interpolating polynomial and an approximation to the value of $f(7)$.

- (b) Construct the interpolating polynomial that fits the following data by using Newton's forward difference interpolation :

x	$f(x)$
0	-1.5
0.1	-1.27
0.2	-0.98
0.3	-0.63
0.4	-0.22
0.5	0.25

Hence, estimate the value of $f(x)$ at $x = 0.15$.

OR

- (c) Describe the trapezoidal rule for numerical integration.

- (d) Evaluate the integral $I = \int_0^4 \frac{dx}{1+x}$ using Simpson's $\frac{1}{3}$ rule.

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(3)

(Turn over)

3. (a) Let A and B be events with $P(A) = \frac{1}{3}$,

$P(A \cup B) = \frac{3}{4}$ and $P(A \cap B) = \frac{1}{4}$, then find :

(i) $P(A \cap B^c)$

(ii) $P(A \cup B^c)$

(b) If A and B are independent events, then prove that :

(i) A^c and B^c are independent

(ii) A and B^c are independent

OR

(c) Find out the standard deviation of the Binomial distribution :

$$f(x) = nC_x p^x q^{n-x}, x = 0, 1, 2, \dots, n$$

(d) Explain Poisson distribution and find out the variance of this distribution.

4. (a) (i) Prove that the number primes is infinite.

(ii) Prove that the prime factorization of an integer $n > 1$ is unique.

(b) (i) Find the highest power of 5 that divides $100!$.

(ii) Verify that whether the congruence $x^2 \equiv -42 \pmod{61}$ has a solution or not?

OR

(c) For any positive integer m and n , prove that $\gcd(m, n) \cdot \text{lcm}(m, n) = mn$.

(d) Prove that $n^P - n$ is divisible by p , where P is prime number and for any natural number n .



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**(INTRODUCTION TO DATABASE
MANAGEMENT SYSTEM)**

1. (a) What is a Database ? Discuss the role of DBMS in managing a database.

(b) Explain the 3-level architecture of DBMS. Mention the schemas corresponding to each level.

OR

(c) What is Data Modelling ? Model an ER diagram for the entities : Supplier, Product and Customer,

- (d) Discuss the role of a database administrator.
2. (a) Explain how records are organized in a sequential file system. What are its merits and demerits ?
- (b) What is Hashing ? What is meant by Address Collision ? How to avoid it ?

OR

- (c) Compare indexed sequential file with sequential file organization.
- (d) How data are organized in a direct access file ? What are the major issues in a direct access file system ?
3. (a) Explain the use of different relational operations in relational data model.
- (b) What is the role of normalization in database design ? Explain the 3rd normal form.

OR

- (c) Explain the first, second and third normal forms with an example.

(d) Write short notes on the following :

- (a) Primary key
- (b) Foreign key
- (c) Candidate key
- (d) Alternative key

4. (a) What is concurrency in a database transaction ? What are the approaches to deal with it ?
- (b) Time stampbased protocol is deadlock free, justify.

OR

- (c) Distinguish among partially commit, abort and commit states of a transaction.
- (d) Why is it essential to ensure atomicity of transactions ? What is meant by durability property of a transaction ?

