

Roll No. _____

Paper Code

3E1201

B.Tech. III-Sem (Main & Back) 2025-26
Artificial Intelligence
3CS2-01 Advanced Engineering Mathematics
AID,CAI,CS,IT,CCS, CDS,CIT,CSD,CSR,AI
3E1201

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.
 (Mentioned in form No. 205)

1. NIL _____ 2. NIL _____

Part A

(Answer should be given up to 25 words only)

All questions are compulsory.

10 x 2 = 20

- Q.1 What is the difference between discrete and continuous random variables?
T-480
- Q.2 Write Chebyshev's inequality.
- Q.3 Define Poisson distribution, and write its mean and variables?
- Q.4 If $y = 3x + 10$ is the best fit for 5 pairs of values (x, y) , by least square method, and $\sum y = 200$; then what is the value of $\sum x$?
- Q.5 What is the difference between linear and nonlinear programming problems?
- Q.6 Match the following type of problems with their descriptions:
- | | |
|----------------------------------|--|
| A. Geometric programming problem | I. Classical Optimization problems |
| B. Quadratic programming problem | II. Objective and constraints are posynomials with positive coefficients |
- T-480

- C. Stochastic programming problem III. Objective is quadratic and constraints are linear
- D. Calculus of variations problem IV. Design variables are nondeterministic or probabilistic
- Q.7 What is Lagrangian function?
- Q.8 Consider the following problem :
Minimize $z = f(X)$,
Subject to $g_j(X) \leq 0 ; j = 1, 2, 3, \dots, m$.
Then write the suitable Kuhn-Tucker conditions.
- Q.9 What is difference between a slack and surplus variable?
- Q.10 Let m and n denotes the numbers of equation and decision variables respectively, then what happens when $m = n$ in a Linear programming problem (LPP)?

Part B

(Analytical/Problem solving questions)

Attempt any Five questions .

5x4=20

- Q.1 Suppose the life in hours of a certain kind of radio tube has the density.
$$f(x) = \frac{100}{x^2}, x \geq 100$$

and zero when $x \leq 100$. What is the probability that none of three such tubes in a radio set will have to be replaced during the first 150 hours of operation? What is the probability that all three of the original tubes will have been replaced during the first 150 hours?
- Q.2 If X is a normal variate with mean 8 and standard deviation 4, find $P(X < 5)$ and $P(5 < X < 10)$. Given from standard normal table that $\phi(0.5) = 0.1915$ and $\phi(0.75) = 0.2734$
- Q.3 Discuss the rank correlation coefficient for the data given below:
- | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| x | 78 | 89 | 97 | 69 | 59 | 79 | 68 | 57 |
| y | 125 | 137 | 156 | 112 | 107 | 136 | 123 | 108 |
- Q.4 A factory makes two products, A and B. Each unit of A requires 2 hours of machining and 1 hour of assembly. Each unit of B requires 1 hour of machining and 3 hours of assembly. The factory has at most

100 machining hours and 120 assembly hours per week. Profit per unit is Rs. 40 for A and Rs. 50 for B. Formulate the linear programming problem.

Q.5 Solve the constrained optimization problem.

$$\text{Min. } f(x, y) = x^2 + y^2, \quad x + y = 1$$

Q.6 Write the dual of the following linear programming problem.

$$\begin{aligned} \text{Maximize} \quad & z = x_1 + 4x_2 + 3x_3 \\ \text{Subject to} \quad & 2x_1 + 3x_2 - 5x_3 \leq 2, \\ & 3x_1 - x_2 + 6x_3 \geq 1, \\ & x_1 + x_2 + x_3 = 4 \\ \text{and} \quad & x_1, x_2, x_3 \geq 0 \end{aligned}$$

Q.7 Using North West Corner Rule, Determine an initial basic feasible solution of the following problem:

	D_1	D_2	D_3	D_4	a_i
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
b_j	6	10	15	4	35

Part C

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any Three questions .

3x10=30

- Q.1 (a) Derive moment generating function for exponential distribution, and hence find its mean and variance.
- (b) Subway trains on a certain line run every half hour between mid-night and six in the morning. What is the probability that a man entering the station at a random time during this period will have to wait at least twenty minutes?

- Q.2 Given the following data on advertising expenditure (X) and sales (Y).
Fit a simple linear regression model of Y on X. Hence, estimate sales when advertising expenditure is Rs. 35,000.

X:	10	20	30	40	50
Y:	25	45	65	70	95

- Q.3 (a) What is optimization? Write its standard mathematical formulation.
(b) Give five applications of optimization in computer science and information technology.

- Q.4 Using Lagrange's multiplier method, solve the following problem.

$$\begin{aligned} \text{Max.} \quad & Z = 4x_1 - x_1^2 + 8x_2 - x_2^2 \\ \text{subject to} \quad & x_1 + x_2 = 4 \\ \text{and} \quad & x_1, x_2 \geq 0 \end{aligned}$$

- Q.5 Using the simplex method, solve the following LPP:

$$\begin{aligned} \text{Min.} \quad & z = 2x_1 + x_2 \\ \text{Subject to} \quad & 3x_1 + x_2 = 3 \\ & 4x_1 + 3x_2 \geq 6 \\ & x_1 + 2x_2 \leq 3 \\ \text{and} \quad & x_1, x_2 \geq 0 \end{aligned}$$

Total No. of Questions: 22

Total No. of Pages: 02

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Paper Code
3E1202

B.Tech. III-Sem (Main & Back) 2025-26
Artificial Intelligence
3CS4-05 Data Structures and Algorithms
AID,CAI,CS,IT,CCS, CDS,CIT,CSD,CSR,AI
3E1202

Time: 3 Hours

Maximum Marks: 70

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1- _____

2- _____

Part A

(Answer should be given up to 25 words only)

All questions are compulsory.

10x2=20

- Q.1 Define stack and mention two applications?
- Q.2 What is the difference between static and dynamic arrays?
- Q.3 Write postfix expression for $(A+B) * (C-D)$
- Q.4 Differentiate between circular queue and priority queue.
- Q.5 List advantages of linked list over arrays.
- Q.6 Write the time complexity of quick sort in best and worst case.
- Q.7 What is difference between AVL Tree and B-Tree.
- Q.8 Define BFS and DFS in graph traversal.
- Q.9 Write the function of hash function in hashing.
- Q.10 State Dijkstra's Algorithm in one line.

Part B

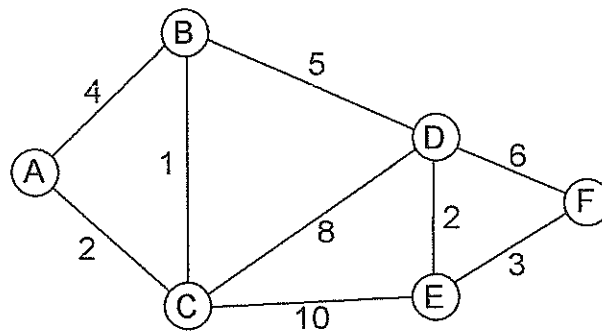
(Analytical/Problem Solving Questions)

Attempt any Five questions .

5x4=20

- Q.1 Convert the following infix expression into postfix and evaluate :
 $(5 + 2) * (8 - 3)$

- Q.2 Explain Round Robin scheduling using queue with an example.
- Q.3 (a) Write short notes on singly linked list and doubly linked list.
(b) Compare linked list with arrays.
- Q.4 Sort the following numbers using heap :
Sort - 15, 8, 3, 20, 10 with explanation.
- Q.5 Find minimum spanning tree of the given graph using Prim's algorithm.



- Q.6 What is hashing? Explain Collision resolution techniques.
- Q.7 Explain bubble sort and quick sort algorithm with complexity.

Part C

(Descriptive/Analytical/Problem solving/Design questions)

Attempt any Three questions .

3x10=30

- Q.1 Explain Heap Sort? Build max heap for the array [9,4,7,1,5,3] and show the array after the First two extract-max. operations.
- Q.2 Describe Binary Search on a sorted array. Provide the iterative algorithm and explain best, average and worst case time complexities.
- Q.3 Explain the difference between a B-tree and a B+tree. Mention one scenario where a B+tree is preferred.
- Q.4 Describe with an example how infix-to-postfix conversion is done using a stack? Show intermediate stack contents for expression : $(A+B) * (C-D)/E$.
- Q.5 Write a short algorithm to implement a circular queue using an array. Explain how you detect full and empty condition.

Total No. of Questions: 22

Total No. of Pages: 02

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Paper Code
3E1203

B.Tech. III-Sem (Main & Back) 2025-26
Artificial Intelligence
3CS3-04 Digital Electronics
AID,CAI,CS,IT,CCS, CDS,CIT,CSD,CSR,AI
3E1203

Time:3 Hours

Maximum Marks :70

Attempt all ten questions from Part A. Attempt any Five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (As mentioned in form No. 205)

1- _____

2- _____

Part A

(Answer should be given up to 25 words only)

All questions are compulsory.

10x2=20

- Q.1 Convert the binary number $(10110,11)_2$ to its decimal equivalent.
- Q.2 What is the 1's complement of the binary number 11010100_2 ?
- Q.3 State the De Morgan's Theorem for two variables A and B.
- Q.4 Define a minterm for a Boolean expression.
- Q.5 What is the purpose of a "Don't Care" condition in a Karnaugh Map?
- Q.6 List two characteristics of TTL logic gates.
- Q.7 What is the main function of an encoder?
- Q.8 Differentiate between a latch and a flip-flop.
- Q.9 How many flip-flops are required to construct a MOD-12 counter.
- Q.10 What is a shift register?

Part B

(Analytical/Problem Solving Questions)

Attempt any Five questions

5x4=20

- Q.1 Discuss the types of Registers with suitable examples and diagrams.
- Q.2 Simplify the following Boolean expression using Boolean algebra theorems.
$$F(A,B,C) = A'B'C' + A'BC' + AB'C' + ABC'$$
- Q.3 Draw the circuit diagram of a 2-input TTL NAND gate and briefly explain its operation.
- Q.4 Design a half-adder circuit using basic logic gates and write its truth table.
- Q.5 Explain the operation of a D flip-flop with its characteristic table.
- Q.6 Convert the following SOP expression to POS form: $F(A,B,C) = \sum m(0,1,3,7)$
- Q.7 Explain the concept of "Fan-out" in digital logic families.

Part C

(Descriptive/Analytical/Problem solving/Design questions)

Attempt any Three questions .

3x10=30

- Q.1 (a) Explain the working principle of a 4-to-1 Multiplexer. Draw its logic diagram.
- (b) Implement the following Boolean function using a 4-to-1 Multiplexer:
$$F(A,B,C) = \sum m(1,2,5,7)$$
- Q.2 Discuss the counters with the state diagram, stat table, and the final logic circuit.
- Q.3 Explain the Quine-McCluskey method for Boolean function minimization. What are its advantages over the K-map method for more variables.
- Q.4 Minimize the following Boolean function using the Karnaugh Map (K-Map) method and draw the logic circuit using NAND gates only:
$$F(A,B,C,D) = \sum m(0,2,5,7,8,10,13,15)$$
- Q.5 Differentiate between RTL, DTL, and CMOS logic families based on their characteristics such as power dissipation, propagation delay, and noise margin.

Total No. of Questions: 22

Total No. of Pages: 02

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Paper Code
3E1204

B.Tech. III-Sem (Main & Back) 2025-26
Artificial Intelligence
3CS4-06 Object Oriented Programming
AID,CAI,CS,IT,CCS, CDS,CIT,CSD,CSR,AI
3E1204

Time:3 Hours

Maximum Marks :70

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

1- _____ 2- _____

Part A

(Answer should be given up to 25 words only)

All questions are compulsory.

10 x 2 = 20

- Q.1 Define member function inside and outside class.
- Q.2 What are the characteristics of OOP?
- Q.3 What is inline function?
- Q.4 What is abstract class and pure virtual function explain it with the help of example?
- Q.5 Explain the concept of reference with the help of example
- Q.6 Explain operator overloading used in C++.
- Q.7 Explain the concept of dynamics binding and virtual function.
- Q.8 What is the role of template in C++?
- Q.9 What is the importance of stream class in OOP?
- Q.10 Explain the concept of class, object, data member, member function with the help of example.

Part B

(Analytical/Problem solving questions)

Attempt any Five questions.

5 x 4 = 20

- Q.1 Differentiate between union & structure with the help of example.
- Q.2 ^{T-480} Differentiate between constructor & destructor with the help of example.
- Q.3 What is friend function explain it with the help of example?
- Q.4 What is the significance of function overriding in C++?
- Q.5 Explain operator overloading with example.
- Q.6 Explain the concept of polymorphism in C++ with the help of example.
- Q.7 What are the function with default argument?

Part C

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any Three questions.

3 x 10 =30

- Q.1 Explain the structure used in C++ and also explain how pointers are used in structure with the help of example.
- Q.2 ^{T-480} Explain the concept of dynamics memory allocation using new and delete operators with the help of an example.
- Q.3 Explain inheritance and types of inheritance in detail with the help of an example.
- Q.4 What do you mean by data binding and encapsulation explain in detail?
- Q.5 Write a short note on :
a) Exceptional handling.
b) File handling.

Total No. of Questions: 22

Total No. of Pages: 02

Roll No. _____

Paper Code

3E1205

B.Tech. III-Sem (Main & Back) 2025-26
Artificial Intelligence
3CS4-07 Software Engineering
AID,CAI,CS,IT,CCS, CDS,CIT,CSD,CSR,AI
3E1205

Time : 3 Hours

Maximum Marks : 70

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

1- _____

2. _____

Part A

(Answer should be given upto 25 words only)

All questions are compulsory.

10x2=20

- Q.1 Explain the requirement analysis of software design life cycle.
Q.2 Define SRS.
Q.3 Explain LOC estimation.
Q.4 Define effort estimation.
Q.5 Explain Data dictionary. Where it is used.
Q.6 What do you mean by procedural design?
Q.7 Explain design principles.
Q.8 Define data Modelling.
Q.9 Explain design documentation.
Q.10 Name two key OOD concepts.

Part B

(Analytical / Problem/Solving questions)

Attempt any five questions.

5x4=20

- Q.1 Explain verification and validation in software engineering.
Q.2 Explain cohesion and coupling in effective modular design.
Q.3 Explain risk analysis in software project management.
Q.4 Differentiate Data flow diagrams (DFDs) and control flow diagram (CFDs)

- Q.5 Define architectural design with help of examples.
Q.6 Explain class and object relationships in object oriented design.
Q.7 Define UML in object oriented modeling.

Part-C

(Descriptive / Analytical / Problem Solving/ Design question)

Attempt any three questions.

3x10=30

- Q.1 Explain waterfall model of software development model with their advantages and disadvantages.
Q.2 A software project is estimated to have 50,000 lines of code (LOC), ie. 50 KLOC. This project is semi-detached type. Calculate the :
1. Effort (in person- months)
2. Development time (in months)
3. Average staffing

Given data for basic COCOMO Model is :

Project Type	a_b	b_b	c_b	d_b
organic	2.4	1.05	2.5	0.38
semi-detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

- Q.3 Explain finite state machine (FSN). Explain its components and applications in software development.
Q.4 Define behavioural modeling. Explain its techniques and significance in structured analysis.
Q.5 Consider a project with the following functional units.
10 low external inputs, 12 high external outputs, 20 low internal logical files, 15 high external interface files, 12 average external inequiries and a value of complexity adjustment factor of 1.10.
(1) What are the unadjusted and adjusted function point counts.
Functional units with weighting factors is as follows.

Functional units	Weighting factors		
	Low	Average	High
External input (EI)	3	4	6
External output (EO)	4	5	7
External Inquiries (EQ)	3	4	6
Internal logical files (ILF)	7	10	15
External Interface files (EIF)	5	7	10