

Roll No. _____

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31N0401

B.TECH. III SEM MAIN/BACK (NEW SCHEME)

ACADEMIC SESSION 2023-24

(Artificial Intelligence And Data Science)

III And Other Branches

3AD1-01 - Advanced Engineering Mathematics

31N0401 /

Common to CS, IT, AI, DS, MC, CM, CD, CA, AD, AM, CY, IO

Time : 3 Hours]

[Max. Marks : 70

[Min. Passing Marks :

Instructions to Candidates :

Part-A : Short Answer Type Questions (up to 25 words) $10 \times 2 = 20$ marks. All 10 questions are compulsory.

Part-B : Analytical/Problem Solving questions $5 \times 4 = 20$ marks. Candidates have to answer 5 questions out of 7.

Part-C : Descriptive/Analytical/Problem Solving questions 3×10 marks = 30 marks. Candidates have to answer 3 questions out of 5.

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

Use of the following supporting materials is permitted during examination. (Mentioned in form no. 205).

1 _____

2 _____

Part-A

10×2=20

1. Find the expected value of the data :

(2)

x	4	5	6	7	8	9
$p(x)$	1/12	1/12	1/4	1/4	1/6	1/6

2. Write down Lagrange's interpolation formula for unequal intervals.

(2)

3. Evaluate :

(2)

$$\Delta \sin(x)$$

4. Define discrete random variable.

(2)

5. Write the names of any *two* methods that are used to solve the transportation problems.

(2)

6. What are mutually exclusive events.

(2)

7. State the necessary and sufficient conditions for the minimum of a function $f(x)$.

(2)

8. Find the Hessian matrix of the function $f(x) = x^2 - y^2$.

(2)

9. Write the formula for the Simpson's $\frac{3}{8}$ rule.

(2)

10. What is a random variable.

(2)

Part-B

5×4=20

1. Evaluate y at $x = 30$ from the data given below using Gauss forward formula :

(4)

x	21	25	29	33	37
y	18.4708	17.8144	17.1070	16.3432	15.5154

2. Solve using Graphical method : (4)

Maximize :

$$z = 4x_1 + 3x_2$$

Subjected to :

$$2x_1 + x_2 \leq 1000$$

$$x_1 + x_2 \leq 800,$$

$$x_1 \leq 400, x_2 \leq 700$$

$$x_1, x_2 \geq 0$$

3. A sample of 100 items is taken from a batch known to contain 40% defectives. Using normal approximations find the probability that contains :

C. At least 44 defectives, <https://www.btubikaner.com>

D. Exactly 44 defectives. (4)

4. Find the moment generating function of Bernoulli variate X with probability mass function $P\{x = 1\} = p, P\{x = 0\} = q, p + q = 1$. Hence find its mean and variance. (4)

5. Find the maximum and minimum values of the function : (4)

$$f(x) = 12x^5 - 45x^4 + 40x^3 + 5$$

6. Find the line of best fit relating to y to x for the following data, plot the line and the data points : (4)

x	2	3	4	5	6	7
y	3.0	5.0	5.5	6.0	8.0	9.5

7. What is the Lagrange multiplier method ? (4)

F-026

(3)

P.T.O.

1. Using modified Euler's method, find the value of y when $x = 0.15$, given that :
(10)

$$\frac{dy}{dx} = x^2 + y, y(0) = 1$$

in three steps.

2. Solve using two-phase method : (10)

Maximize :

$$z = 2x_1 + x_2$$

Subjected to :

$$x_1 + x_2 \geq 2$$

$$x_1 + x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

3. Calculate the Karl Pearson's coefficient of correlation between the age of husband (x) and wife (y) for the data given below : (10)

x	y
23	18
27	20
28	22
28	27
29	21
30	29
31	27
33	29
35	28

4. The joint density function of X and Y is given by : (10)

$$f(x,y) = \begin{cases} 2e^{-x}e^{-2y}, & 0 < x < \infty, 0 < y < \infty \\ 0, & \text{otherwise} \end{cases}$$

Find :

- (a) $P\{X > 1, Y < 1\}$
 (b) $P\{X < Y\}$
 (c) $P\{x < a\}$
5. Find the dimension of a box of largest volume that can be inscribed in a sphere of unit radius. (10)

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