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B. Tech. III - Sem. (Main) Exam., (Academic Session 2021- 2022)
Computer Science and Engineering
3CS2 – 01 Advance Engineering Mathematics
Common to CSE/IT/AI & ML/CSE (DS)/CSE (AI &ML)/CSE (AI)

Time: 2½ Hours

Maximum Marks: 120
Min. Passing Marks:

Instructions to Candidates:

Part – A: Short answer questions (up to 25 words) 6×3 marks = 18 marks.
Candidates have to answer **six** questions out of **ten**

Part – B: Analytical/Problem solving questions 3×10 marks = 30 marks.
Candidates have to answer **three** questions out of **seven**.

Part – C: Descriptive/Analytical/Problem Solving questions 3×24 marks = 72 marks.
Candidates have to answer **three** questions out of **five**.

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

1. NIL

2. NIL

PART – A

Q.1 A continuous random variable X that can assume any values between $x = 2$ and $x = 5$ has a density function given by $f(x) = k(1+x)$. Find $p(x < 4)$.

Q.2 Define Skewness and Kurtosis.

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- Q.3 If x is a uniform variate in interval (a, b) then find mean of x .
- Q.4 What is the principle of least squares?
- Q.5 Establish relationship between second moment about mean and moments about origin.
- Q.6 Derive the formula for angle of intersection between two regression lines y on x and x on y .
- Q.7 Write the dual of the following -
- $$\text{Max } Z = 4x_1 + 5x_2$$
- Subject to $x_1 + x_2 \leq 3$,
- $$3x_1 + 4x_2 \leq 10, x_1, x_2 \geq 0$$
- Q.8 Find the critical points of -
- $$f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6.$$
- Q.9 Define the feasible solution, basic feasible solution and optimal solution of L. P. P.
- Q.10 Write down the optimality criteria of Modified Distribution Method (MODI).

PART – B

- Q.1 A fair dice is tossed 720 times. Use Chebyshev's inequality to find a lower bound for the probability of getting 100 to 140 sixes.
- Q.2 Find the mean and variance of binomial distribution.

Q.3 Determine the points of maxima or minima for the function -

$$f(x_1, x_2) = -x_1^2 - x_2^2 + x_1 x_2 + 2x_2 + x_1.$$

Q.4 Calculate the correlation coefficient for the following heights (in inches) of fathers (x) and their sons (y).

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

Q.5 Explain the classification of optimization problems.

Q.6 A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of days on which -

- (i) neither car is used
- (ii) some demand is refused

Q.7 Five men are available to do five different Jobs. From past records, the time (in hours) that each man takes to do each Job is known and given in the following table:

		Job				
		I	II	III	IV	V
Man	A	2	9	2	7	1
	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

Find the assignment of man to Jobs that will minimize the total time taken.

PART – C

- Q.1 If (x, y) is a two dimensional random variable uniformly distributed i.e. $f(x, y) = k$ over the triangular region R bounded by $y = 0$, $x = 3$ and $y = 4x/3$. Find $E(x)$, $\text{Var}(x)$, $E(y)$, $\text{Var}(y)$.
- Q.2 Find the moment generating function of a normal random variable x with mean μ and variance σ^2 .
- Q.3 Using Two-phase method solve -
Min $Z = x_1 + x_2$
Subject to $2x_1 + x_2 \geq 4$, $x_1 + 7x_2 \geq 7$ and $x_1, x_2 \geq 0$.
- Q.4 Find the optimal solution of the following transportation problem in which cell entries represent unit cost.

	x	y	z	Available
A	8	7	3	60
B	3	8	9	70
C	11	3	5	80
Requirement	50	80	80	210

Q.5 Minimize $f(x) = \frac{1}{2}(x_1^2 + x_2^2 + x_3^2)$

Subject to $g_1(x) = x_1 - x_2 = 0$

$g_2(x) = x_1 + x_2 + x_3 - 1 = 0$

by Lagrange's Multiplier Method.
