3E1136

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B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019

BSC Computer Science & Engineering

3CS2-01 Advanced Engineering Mathematics

CS, IT

Time: 3 Hours **Maximum Marks: 120**

Instructions to Candidates:

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

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

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 What is the coefficient of skewness, if the man and mode of the distribution are equal?

Q.2 What is the variance of the Poisson distribution with mean value 5?

Q.3 Define the exponential distribution.

Q.4 What is optimization?

Q.5 Match the following type of problems with their descriptions –

(a)	Geometric programming problem	(i)	Classical optimization problem
(b)	Quadratic programming problem	(ii)	Objective and constraints are posynomials with positive coefficients
(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.6 Write four engingeering applications of optimization.

Q.7 Consider the following problem –

Minimize $z = f(X)$,

Subject to $g_j(X) \leq 0; j = 1, 2, 3, \ldots, m.$

Then write the suitable Kuhn – Tucker conditions.

Q.8 What is difference between a slack and surplus variable?

Q.9 What happens when m = n in a Linear Programming Problem (LPP)? Where m and n denotes the numbers of equation and decision variables respectively.

Q.10 For non – degenerate feasible solution of m × n transportation problem, how many independent individual positive assignments will be required?

PART – B

(Analytical/Problem solving questions) **[5×8=40]**

Attempt any five questions

Q.1 A box contains 'a' white and 'b' black balls, 'c' balls are drawn. Find the expected value of the number of white balls drawn.

Q.2 The joint probability density function of a two – dimensional random variable (X, Y) is given by –

$$f(x,y) = \begin{cases} 2, & 0 < x < 1, 0 < y < x \\ 0, & \text{elsewhere} \end{cases}$$

Find the marginal density functions of X and Y. Also find the conditional density function of Y given X = x and conditional density function of X.

Q.3 Fit a straight line to the following data –

X	1	2	3	4	6	8
Y	2.4	3	3.6	4	5	6

Q.4 A company desires to devote the excess capacity of the three machines lathe, shaping and milling to make three products A, B and C. The available time per month in these machines are tabulated below –

Machine	Lathe	Shaping	Milling
Available time per month	200 hours	110 hours	180 hours

The time (in hours) taken to produce each unit of the products A, B and C on the machines is displayed in the table below –

Machine	Lathe	Shaping	Milling
Product A	5	2	4
Product B	2	2	Nil
Product C	3	Nil	3

The profit per unit of the products A, B and C are ₹ 20, ₹ 15 and ₹ 12 respectively. Formulate the mathematical model to maximize the profit.

Q.5 Find the maximum and minimum value of the function –

$u = x^3 + y^3 - 3x - 12y + 50$

Q.6 Find the optimum of the following constrained multivariable problem –

Minimize $Z = -x_1^2 + (x_2 + 1)^2 + (x_3 - 1)^2$

Subject to $x_1 + 5x_2 - 3x_3 = 6$

$x_1, x_2, x_3 \geq 0.$

Q.7 Using two phase simplex method, solve the following linear programming problem –

Max. $z = -x_1 - x_2$

Subject to $3x_1 + 2x_2 \geq 30$

$-2x_1 - 3x_2 \leq -30$

$x_1 + x_2 \leq 5$

and $x_1, x_2 \geq 0$

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[4×15=60]**

Attempt any four questions

Q.1 (a) Find mean and variance of Poison distribution.

(b) How optimization problem are classified based on the nature of expressions?

Q.2 (a) Using Simplex method, show that the following linear programming problem has an unbounded solution –

Maximize $z = x_1 + 2x_2$

Subject to $x_1 - x_2 \leq 10$

$3x_1 - 2x_2 \leq 40$

$x_1, x_2 \geq 0$

(b) Calculate the coefficient of correlation from the following data –

X	1	2	3	4	5	6	7	8	9
Y	9	8	10	12	11	13	14	16	15

Q.3 If the skulls are classified as A, B and C according as the length – breadth index is under 75, between 75 and 80, or over 80. Using normal distribution find approximately the mean and standard deviation of a series in which A are 58%, B are 38% and C are 4%, being given that –

$$f(t) = \frac{1}{\sqrt{2\pi}} \int_0^t \exp(-x^2/2)dx,$$

then $f(0.20) = 0.08$ and $f(1.75) = 0.46$.

Q.4 Solve the following problem using Kuhn – Tucker conditions –

Minimize $f(x_1, x_2, x_3) = x_1^2 + x_2^2 + x_3^2$

$g_1 = 2x_1 + x_2 - 5 \leq 0$

$g_2 = x_1 + x_3 - 2 \leq 0$

$g_3 = 1 - x_1 \leq 0$

$g_4 = 2 - x_2 \leq 0$

$g_5 = -x_3 \leq 0.$

Q.5 (a) Write the dual of the following problem –

Minimize $z = 2x_1 + x_2$

Subject to $3x_1 + x_2 \geq 3, 4x_1 + 3x_2 \geq 6, x_1 + 2x_2 \geq 2$

and $x_1, x_2, x_3 \geq 0$

(b) Using Vogel's Approximation method, find basic feasible solution for the following unbalanced transportation problem –

	Destination				Availability
	X	Y	Z	W	
I	14	19	11	20	10
II	19	12	14	17	15
III	14	16	11	18	12
Requirement	8	12	16	14	
