310901

Roll No. ____________

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

Common for CS/IT

3CS2-01 Advance Engineering Mathematics

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

Instructions to Candidates:

Part – A: *Short answer questions (up to 25 words) 10 × 2 marks = 20 marks. All ten questions are compulsory.*

Part – B: *Analytical/Problem Solving questions 5 × 8 marks = 40 marks. Candidates have to answer five questions out of seven.*

Part – C: *Descriptive/Analytical/Problem Solving questions 4 × 15 marks = 60 marks. Candidates have to answer four 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 materials is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART - A

Q.1 Define random variable.

Q.2 What is the coefficient of skewness, if the mean and mode of the distribution are equal?

Q.3 If mean of Poisson distribution is 3, then what is the value of variance?

Q.4 Define the uniform distribution.

Q.5 What is optimization?

Q.6 Write at least two methods for solving a multivariable optimization problem with equality constraints.

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 If the given LPP has an optimal solution, then what about the solution of dual problem?

Q.10 Define unbalanced transportation problem.

PART – B

Q.1 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.2 Derive moment generating function for Binomial distribution. Hence, find mean and variance for the same.

Q.3 Suppose on an average 1 house in 1000 in a certain district has a fire during a year. If there are 2000 houses in that district, what is the probability that exactly 5 houses will have a fire during the year?

Q.4 A firm manufactures 3 products A, B and C. The profits are ₹ 3, ₹ 2 and ₹ 4 respectively. The firm has 2 machines and below is the required processing time in minutes for each machine on each product.

		Product		
		A	B	C
Machine	G	4	3	5
	H	2	2	4

Machine G and H have 2,000 and 2,500 machine-minutes respectively. The firm must manufacture 100 A's, 200 B's and 50 C's, but no more than 150A's. Formulate the mathematical model to maximize profit.

Q.5 A beam of length l is supported at one end. If v is the uniformly distributed load per unit length and the bending moment M at a distance x from the end is given by

$$M = lx - \frac{1}{2}\omega x^2.$$

then find the maximum bending moment.

Q.6 Using the Lagrange's multiplier method, find the minimum value of $x^2 + y^2 + z^2$ when $ax + by + cz = p$.

Q.7 Using Simplex method, show that the following linear programming problem has an unbounded solution:

Maximize $z = x_1 + 2x_2$

Subject to $x_1 - x_2 \leq 10$

$3x_1 - 2x_2 \leq 40$

And $x_1, x_2 \geq 0$