Reg. No.



## I SEMESTER M.TECH. (ENVIORNMENTAL ENGG.) END SEMESTER EXAMINATIONS FEBRUARY2021 SUBJECT: COMPUTATIONAL METHODS AND OPTIMIZATION TECHNIQUES [MAT 5160]

Time : 3 hrs

Max. Marks: 50

Instructions to Candidates:

Answer ALL the questions. Use of STATISTICAL TABLES is permitted

Marks of each question (3+3+4)

- 1A. Find the mean and variance of chi-square distribution.
- 1B. A player tosses 3 coins. He wins Rs 9 if three heads appear, Rs 7 if two heads appear and Rs 2 if 1 head appear. On the other hand he losses Rs 20 if three tails appear. What is expected profit?

1C. Find the pdf of  $Y = 8X^3$  if X has the pdf  $f(x) = \begin{cases} 2x; 0 \le x \le 1\\ 0; elsewhere \end{cases}$ .

- 2A. A random sample of size 15 from a population  $n(\mu, \sigma^2)$  yields.  $\overline{X} = 3.2$  and  $S^2 = 4.24$ . Find a 95 percent confidence interval for  $\sigma^2$ .
- 2B. Compute the probability that mean of random sample size 15 from  $f(x) = 3x^2$ ; 0 < x < 1 is between  $\frac{3}{5}$  and  $\frac{4}{5}$ .
- 2C Continuous random variable has pdf  $f(x) = \frac{x}{2}$ , 0 < x < 2. (a) Two independent determination are made. What is the probability that

both these determinations are greater than 1.

- (b) If three independent determination are made. What is the probability that at least two of these determinations are greater than
- 3A. If  $\overline{X}$  is mean of a random sample of size n from a distribution N( $\mu$ , 100). Then find n such that P( $\mu - 5 < \overline{x} < \mu + 5$ ) = 0.954

A random variable has the following distribution

	Value (x)	0	1	2	3	4	5	6	7
	P(x)	a	3a	5a	7a	9a	11a	13a	18a
Find	(i) a (ii)	(ii) P(X < 6)			(iii) $P(1 < x < 4)$				

- 3C. Let  $(X_1, X_2, ..., X_n)$  denote a random sample from a distribution  $N(\theta_1, \theta_2)$ . Find M.L.E for  $\theta_1$ ,  $\theta_2$ .  $(-\infty < \theta_1 < \infty, 0 < \theta_2 < \infty)$
- 4A. Solve  $\nabla^2 u = -81xy, \ 0 < x < 1, \ 0 < y < 1, h = \frac{1}{3}. \ u(0, y) = u(x, 0) = 0. \ u(1, y) = u(x, 1) = 100.$
- 4B. In a normal distribution 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation.
- 4C. Find the correlation coefficient for

X	92	89	87	86	83	77	71	63	53	50	
у	86	88	91	77	68	85	52	82	37	57	

- 5A A bag contains three coins, one of which coin with two heads while other two are normal and not biased. A coin is chosen at random from the bag tossed four times in succession. If each time head turns up, what is probability that it is a normal coin.
- 5B Find the correlation coefficient between X & Y given f(x,y) = x + y : 0 < x, y < 1
- 5C (a) If X follows B(3, 1/3) and Y follows B(5,1/3) then find P( $X + Y \ge 1$ ).

(b) A symmetric die is thrown 600 times. Find the lower bound of probability of getting 80 to 120 sixes.

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<sup>3</sup>B.