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Printed Page:-6 **Subject Code:- BAS0303N**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: III - THEORY EXAMINATION (2025 - 2026)
Subject: Statistics and Probability

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. The following measure is least affected by extreme values: (CO1,K1) 1

(a) Mean
(b) Standard deviation
(c) Quartile deviation
(d) Range

1-b. An additional observation 15 is included in a series of 11 observations and its mean remains unaffected. The mean of the series was: (CO1, K3) 1

(a) 11
(b) 15
(c) 165
(d) 4

1-c. If r = 0, then the angle between the two regression lines is... (CO2, K2) 1

(a) Sixty degree
(b) Thirty degree
(c) Zero degree
(d) Ninety degree

1-d. The arithmetic mean of the two regression coefficients is: (CO2, K1) 1

(a) Greater than or equal to the correlation coefficient
(b) Less than correlation coefficient
(c) Equal to correlation coefficient
(d) Greater than the standard deviation

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1-e. If X is a continuous random variable with CDF F(x), then $F(\infty)$ is equal to: (CO3, K1) 1

(a) -1
(b) 0
(c) 1
(d) ∞

1-f. For the joint p.d.f. f(x, y), the marginal distribution of Y is given as: (CO3, K1) 1

(a) $\sum_{\text{all } x} f(x, y)$
(b) $\int_{-\infty}^{\infty} f(x, y)\,dx$
(c) $\int_{-\infty}^{\infty} f(x, y)\,dy$
(d) $\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f(x, y)\,dx\,dy$

1-g. Mean of Exponential distribution is…… (CO4, K1) 1

(a) $-1/\lambda$
(b) $1/\lambda^2$
(c) $2/\lambda$
(d) $1/\lambda$

1-h. If X is a random variable and a and b are constants then the variance Var(ax+b) =……..(CO4, K2) 1

(a) Var(x)+b
(b) aVar(x)
(c) a^2Var(x)
(d) aVar(x)+b

1-i. The degree of freedom are associated with a Chi-Square test of independence for a contingency table with R rows and C columns is: (CO5, K1) 1

(a) R-1
(b) C-1
(c) (R-1)(C-1)
(d) (R-1)+ (C-1)

1-j. If the value of S_1^2 =36.267 and S_2^2 =30.47 , then the value of test statistic F is: (CO5, K2) 1

(a) 1.5
(b) 1.190
(c) 1.8
(d) 1.7

2. Attempt all parts:-

2.a. A cooperative bank has two branches employing 50 and 70 workers respectively. The average salaries paid by two respective branches are Rs. 360 and Rs. 390 per 2

month. Calculate the mean of the salaries of all the employees. (CO1, K3)

2.b. Prove that both regression coefficients have the same sign as the correlation coefficient. (CO2,K2) 2

2.c. If X be a random variable with the following PDF $f(x) = \begin{cases} kx^3; & 0 < x \leq 1 \\ 0; & \text{otherwise} \end{cases}$, then find the value of k . (CO3, K3) 2

2.d. The lifetime of a bulb follows an exponential distribution with average 5 hours. Find the probability that bulb work for more than 3 hours.(CO4, K2) 2

2.e. Define test statistic. (CO5,K1) 2

SECTION-B 30

3.a. Answer any one of the following:-

3.a.(i) The weekly wages in Rs. of the workers in a shoe factory are given below: 6

Weekly wages (in Rs.)	500-600	600-700	700-800	800-900	900-1000	1000-1100
No. of workers	8	12	4	2	1	1

Calculate Karl Pearson's coefficient of skewness. (CO1, K3)

3.a.(ii) Calculate Quartile deviation for the following data: (CO1, K3) 6

C.I.	0-10	10-20	20-30	30-40	40-50	50-60
f	9	15	29	24	3	20

3.b. Answer any one of the following:-

3.b.(i) Ten students got the following percentage of marks in principles of economics (x) and statistics (y): 6

Roll no	1	2	3	4	5	6	7	8	9	10
x	78	36	98	25	78	82	90	62	65	39
y	86	51	91	60	68	62	86	58	53	47

Calculate the rank correlation co-efficient between x and y. (CO3, K3)

3.b.(ii) Calculate production corresponding to a rainfall of 40 inches from given data by using linear regression equation: (CO2, K3) 6

	Rainfall in inches(x)	Production in Kg(y)
Mean	30	500
S.D.	5	100

Given: Karl Pearson Coefficient of correlation = 0.8.

3.c. Answer any one of the following:-

3.c.(i) In a factory, the number of defective items produced in a day follows a discrete distribution. The joint probability distribution of the number of defective items in two consecutive days is given by: (CO3, K3) 6

Day 1(x)	Day 2 (y)		
	0	1	2
0	0.3	0.1	0.05

1	0.2	0.15	0.1
2	0	0.05	0.05

(a) Find the probability that exactly 1 defective item was produced on the first day and 2 defective items on the second day.

(b) Find the marginal probability distribution of x and y.

3.c.(ii) From the below probability mass function table, calculate CDF at each given value of x.(CO3,K3) 6

x	1	2	3	4
p(x)	0.2	0.05	0.25	0.5

3.d. Answer any one of the following:-

3.d.(i) Find the moment generating function of binomial distribution. (CO4, K3) 6

3.d.(ii) Find the mean and variance of the random variable *X* having the following probability distribution.(CO4,K3) 6

X =x	1	2	3	4	5	6	7	8	9	10
P(x)	0.15	0.10	0.10	0.01	0.08	0.01	0.05	0.02	0.28	0.20

3.e. Answer any one of the following:-

3.e.(i) Two samples of sodium vapour bulbs were tested for length of life and the following results were got: 6

	Size	Sample mean	Sample S.D.
Tyoe I	8	1234 hrs	36 hrs
Type II	7	1036 hrs	40 hrs

Is the difference in the means significant to generalise the type I is superior to Type II regarding length of life?
(Given tabulated value is 1.77) (CO5, K3)

3.e.(ii) The following table shows the number of missing rivets observed at the time of inspection of 12 aircrafts. Find the control limits for the number of defects chart and comment on the state of control. (CO5, K3) 6

Aircraft No	1	2	3	4	5	6	7	8	9	10	11	12
No. of missing rivets	7	15	13	18	10	14	13	10	20	11	22	15

SECTION-C 50

4. Answer any one of the following:-

4-a. The number of flowers on sunflower plants are given below: 10

No. of flowers	3	6	12	16	25
No. of plants	1	2	3	4	5

Calculate the first four moments about mean and also calculate coefficient of skewness and Kurtosis. (CO1, K3)

4-b. Calculate the standard deviation and mean deviation about mean for the following distribution: (CO1, K3) 10

C.I.	2.5-7.5	7.5-12.5	12.5-17.5	17.5-22.5	22.5-27.5	27.5-32.5	32.5-37.5
Freq.	8	15	20	32	23	17	5

5. Answer any one of the following:-

5-a. Fit the curve $y = a b^x$ to the following data-(CO2, K3) 10

x	2	3	4	5	6
y	8.3	15.4	33.1	65.2	127.4

5-b. Find the means of X and Y variables and the Karl Pearson coefficient of correlation between them from the following two regression equations: (CO2,K3) 10

2Y-X=50

3Y-2X=10

6. Answer any <u>one</u> of the following:-

6-a. A random variable X is distributed at random variable between the values 0 and 1 so that its probability density function is $f(x) = kx^2(1-x^3)$ where k is constant. Find the value of k , find its mean and variance. (CO3, K3) 10

6-b. If X and Y are two random variables having the joint probability density function $f(xy) = 6x^2y$ where $0 < x < 1$ and $0 < y < 1$. 10

Find the marginal distribution of X and Y. Also, the conditional distribution of Y given X. (CO3, K3)

7. Answer any <u>one</u> of the following:-

7-a. The mean yield per plot of a crop is 17kg and standard deviation is 3kg. If the distribution of yield per plot is normal, find the percentage of plots giving yields: (CO4, K3) 10

i) Between 15.5 kg and 20 kg

ii) More than 20 kg.

Given that the area under the standard curve between $z=0$ and $z=1$ is 0.3413, between $z=0$ and $z=0.5$ is 0.1915.

7-b. Fit a Poisson distribution to the following data and calculate theoretical frequencies. (CO4, K3) 10

Deaths	0	1	2	3	4	5
Frequencies	22	34	27	12	4	1

8. Answer any <u>one</u> of the following:-

8-a. Two sample polls of votes for two candidates A and B for a public office are taken. The results are given in the table. Examine whether the nature of area is related to voting preferences in this election or not. 10

Area	A	B	Total
Rural	620	380	1000
Urban	550	450	1000
Total	1170	830	2000

If the tabulated value is 3.841 at 5% LOS. (CO5, K3)

8-b. A manufacturing company purchased three new machines of different makes and wishes to determine whether one of them is faster than the others in producing a certain output. Five hourly production figures are observed at random from each machine and results are given below: 10

A	B	C
20	18	25

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21	20	28
23	17	22
16	25	28
20	15	32

Use ANOVA and determine whether the machines are significantly different in their mean speed. Given that the tabular value $F_{(2,12)}=3.89$ at 5% LOS. (CO5, K3)