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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech Integrated

SEM: IV - 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

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1. Attempt all parts:-

- (1.1) The variance of 15 observations is 4. If each observation is increased by 9, then the variance of the resulting observations is: (CO1,K2) 1
(a) 5 (b) 6 (c) 7 (d) 4
- (1.2) If mode=80 and mean=110, then the median is: (CO1,K2) 1
(a) 110 (b) 120 (c) 100 (d) 90
- (1.3) If the sum of the product of deviations of x and y series from their means is equal to zero, then correlation coefficient is (CO2, K2) 1
(a) 0 (b) 1 (c) -1 (d) None of these
- (1.4) 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
- (1.5) The joint distribution function of two random variables X,Y is (CO3, K1) 1
(a) $P(X=x, Y \leq y)$ (b) $P(X > x, Y > y)$ (c) $P(X \leq x, Y \leq y)$ (d) $P(X=x)+P(Y=y)$
- (1.6) 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) ∞
- (1.7) The variance of exponential distribution is given as _____(CO4, K1) 1
(a) $1/\lambda$ (b) λ (c) λ^2 (d) $1/\lambda^2$
- (1.8) For Binomial distribution sum of mean and variance is 6 and difference of mean and variance is 2 then the probability of success is..... (CO4, K2) 1
(a) 0.75 (b) 0.25 (c) 1 (d) 0.5
- (1.9) The degree of freedom for chi-square test for a contingency table of order 2 x 3 is: (CO5, K2) 1
(a) 0 (b) 1 (c) 2 (d) 4

- (1.10) If the null hypothesis is $H_0: \mu = 100$, then the alternative hypothesis is: (CO5, K2) 1
- (a) $H_0: \mu \neq 100$ (b) $H_1: \mu \neq 100$
- (c) $H_1: \mu = 100$ (d) None of the above

2. Attempt all parts:-

- (2.1) 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 month. Calculate the mean of the salaries of all the employees. (CO1, K3) 2
- (2.2) Write normal equations for fitting of the following curve: $y = a x^b$ (CO2, K2) 2
- (2.3) If X be a random variable with pdf function is given by $f(x) = \begin{cases} 4x^3; & 0 < x \leq 1 \\ 0; & \text{otherwise} \end{cases}$, then determine the probability $P\left(\frac{1}{3} < x < \frac{2}{3}\right)$. (CO3, K3) 2
- (2.4) In mathematics final examination, if the mean marks was 72, and the standard deviation was 15, where marks follow normal distribution. Determine the standard scores of students receiving grade 93. (CO4, K2) 2
- (2.5) In ANOVA one-way classification involving 4 classes each having 12 observations, Calculate the degrees of freedom associated with error sum of squares. (CO5, K2) 2

SECTION-B

Answer any one of the following:-

- (3.1) For a distribution, Bowley's coefficient of skewness is -0.56, upper quartile=16.4 and median=24.2 then Calculate the coefficient of quartile deviation. (CO1, K3) 6
- (3.2) Calculate the mode of the following frequency distribution by Grouping method. (CO1, K3) 6

Size (x)	1	2	3	4	5	6	7	8	9	10	11	12
Frequency (f)	3	8	15	23	35	40	32	28	20	45	14	6

Answer any one of the following:-

- (3.3) Compute the Rank correlation coefficient between X and Y from the following table: (CO2, K3) 6

X	35	54	80	95	73	73	35	91	83	81
Y	40	60	75	90	70	75	38	95	75	70

- (3.4) The following are the two regression lines of variables x and y: $6x - 5y + 30 = 0$ and $3x - 2y + 12 = 0$ Calculate: 6
- i) The Mean values of x and y
- ii) Also the Correlation coefficient between x and y. (CO2, K3)

Answer any one of the following:-

- (3.5) A two-dimensional random variable (X, Y) has a bivariate distribution is given by: 6
- $$P(X=x, Y=y) = \frac{x+y^2}{13} \text{ for } x=0,1 \text{ and } y=0,1,2. \text{ (CO3, K3)}$$
- i) Verify that joint PMF is valid.
- ii) also find marginal distributions of X and Y.

- (3.6) For the probability density function: $f(x) = \begin{cases} k(4-x^2); & 0 \leq x \leq 2 \\ 0; & \text{otherwise} \end{cases}$, Calculate the value of k and $P(1 \leq x \leq 1.5)$. (CO3, K3) 6

Answer any one of the following:-

- (3.7) Determine the mean and variance of Binomial distribution. (CO4, K3) 6
- (3.8) Assume that the probability of an individual coal miner being killed in a mine accident during a year is $1/2400$. Using Poisson's distribution find the probability that in a mine employing 200 miners, there will be (CO4, K3) 6
- i) At least one fatal accident in a year.
- ii) Exactly two fatal accidents in a year.

Answer any one of the following:-

- (3.9) The following table gives the number of accidents that took place in an industry during various days of week. Test if accidents are uniformly distributed over the week 6

Day	Mon	Tue	Wed	Thu	Fri	Sat
No. of accidents	14	18	12	11	15	14

If the tabulated value is 11.09 at 5% level of significance. (CO5, K3)

- (3.10) Samples of sizes 10 and 14 were taken from two normal population with S.D. 3.5 and 5.2. The sample means were found to be 20.3 and 18.6. Test whether the means of two populations are the same at 5% level. (Tabular value is 2.0739) (CO5,K3) 6

SECTION-C

4. Answer any one of the following:-

- (4.1) Calculate the moment coefficient of skewness and coefficient of kurtosis of the frequency distribution given below and comment on the nature of distribution. (CO1, K3) 10

C.I.	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Frequency	3	5	7	9	11	13	15

- (4.2) The Median and Mode of the following wage distribution are known to be Rs. 33.50 and Rs. 34 respectively, Calculate the value of f_3 , f_4 and f_5 . (CO1, K3) 10

Wages	0-10	10-20	20-30	30-40	40-50	50-60	60-70	Total
Freq.	4	16	f_3	f_4	f_5	6	4	230

5. Answer any one of the following:-

- (5.1) Determine the multiple linear regression equation of x_1 on x_2 and x_3 from the data relating to three variables (CO2, K3) 10

x_1	3	5	6	8	12	10
x_2	10	10	5	7	5	2
x_3	20	25	15	16	15	2

- (5.2) The pressure (P) on the gas corresponding to various volumes (V) is measured given by the following data:(CO2, K3) 10

V	50	60	70	90	100
P	64.7	51.3	40.5	25.9	78

Fit the data to the following equation $PV^r = C$.

6. Answer any one of the following:-

- (6.1) If X and Y are two random variables having the joint density function: 10
- $$f(x,y) = \begin{cases} 4xy; & 0 \leq x < 1, 0 \leq y < 1 \\ 0; & \text{elsewhere} \end{cases}$$

i) Check whether $f(x,y)$ is a joint PDF or not.

ii) also calculate the $P(X < 0.5, Y < 0.5)$,

iii) $P(X+Y < 1)$. (CO3, K3)

(6.2) A random variable X has the following probability distribution:

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X	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	3k ²	2k ²	7k ² +k

i) Determine the constant k

ii) Also determine the cumulative distribution function of X (CDF)

iii) Compute $P(1.5 < X < 4.5/X > 2)$. (CO3, K3)

7. Answer any one of the following:-

(7.1) Fit a Poisson distribution to the following data which gives the number of yeast cells per square for 400 squares. (CO4, K3)

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X	0	1	2	3	4	5	6	7	8	9	10	Total
(f)	103	143	98	42	8	4	2	0	0	0	0	400

(7.2) 2000 students appeared in an examination. Distribution of marks is assumed to be normal with mean $\mu=30$ and $\sigma=6.25$. Find the number of students those are expected to get marks:

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(i) Between 20 and 40

(ii) Less than 35 and

(iii) Above 50.

Given that the area under the standard curve between $z=0$ and $z=1.6$ is 0.4452,

between $z=0$ and $z=0.8$ is 0.2881 and between $z=0$ and $z=3.2$ is 0.4987. (CO4, K3)

8. Answer any one of the following:-

(8.1) The number of defectives in 17 samples of size 500 each is shown in the following table:

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Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No. of defective	20	25	35	45	15	65	15	20	35	23	12	9	21	22	32	35	38

Determine the control limits for the chart of the number of defective units and also check whether the process is under control or not with graph. (CO5, K3)

(8.2) Four salesmen were posted in different areas by a company. The number of unit x sold by them are as follows:

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A	20	23	28	29
B	25	32	30	21
C	23	28	35	18
D	15	21	19	25

On the basis of this information can it be concluded that there is significant difference in the performance of four salesmen? Given that the tabular value $F(3,12)=3.24$ at 5% LOS. (CO5, K3)