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Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2021 - 2022)

Subject: Engineering Mathematics- IV

Time: 3 Hours Max. Marks: 100

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 mark each & Question No- 2 carries 2 mark each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. 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 Spearman rank correlation coefficient is given by- (CO1) 1

(a) $r = 1 - 6\frac{\sum(d^2)}{n(n^2-1)}$

(b) $r = 1 - 6\frac{\sum(d^2)}{(n^2-n)}$

(c) $r = 1 - \frac{\sum(d^2)}{n(n^2-1)}$

(d) $r = 1 - 6\frac{\sum(d^2)}{(n^3-1)}$

1-b. Correlation coefficient is _____ of regression coefficient. (CO1) 1

(a) Harmonic mean

(b) Arithmetic mean

(c) Geometric mean

(d) None of these

1-c. The test statistic of the mean of a small random sample of size n with standard deviation s from population with mean μ is given by : (CO2) 1

(a) $\frac{\bar{x}-\mu}{s/\sqrt{n}}$

(b) $\frac{\bar{x}-\mu}{s/n}$

(c) $\frac{\bar{x}-\mu}{s/\sqrt{n-1}}$

(d) $\frac{\bar{x}-\mu}{s/(n-1)}$

1-d. Which of the following distribution is used to compare two variances? (CO2) 1

(a) t–Test
(b) F –Test
(c) Normal Distribution
(d) Poisson Distribution

1-e. The value of k for which the function $f(x)=\begin{cases} k\,e^{-3x}, & x>0 \\ 0, & \text{otherwise} \end{cases}$ is probability density function, is (CO3) 1

(a) 1
(b) 2
(c) 3
(d) 1/3

1-f. A table with all possible value of a random variable and its corresponding probabilities is called _____ (CO3) 1

(a) Probability Mass Function
(b) Probability Density Function
(c) Cumulative distribution function
(d) Probability Distribution

1-g. Consider a random variable with exponential distribution with $\lambda=1$. Then the probability for P (X>3) is (CO4) 1

(a) e^{-3}
(b) e^{-1}
(c) e^{-2}
(d) None of these

1-h. Normal Distribution is symmetric about _____ (CO4) 1

(a) Variance
(b) Mean
(c) Standard deviation
(d) Covariance

1-i. The unit digit of 7^{73} is (CO5) 1

(a) 1
(b) 9
(c) 7
(d) None of these

1-j. A mapping function $f:X\to Y$ is one-one, if (CO5) 1

(a) $f(x)=f(y)$ for $x,y\in X$
(b) $f(x)=f(y)\Rightarrow x=y$ for all $x,y\in X$
(c) $x=y\Rightarrow f(x)=f(y)$ for all $x,y\in X$
(d) none of these

2. Attempt all parts:-

2.a. For certain data, 3X+2Y-26=0 and 6X+Y-31=0 are the two regression equations. Find the values of means and coefficient of correlation. (CO1) 2

2.b. A random sample of 200 items from a large population gave a mean 50 and S.D. of 9. Determine the 95% confidence interval for the mean of population. (CO2) 2

2.c. A die is tossed thrice. A success is getting 1 or 6 on a toss. Find the mean and the variance of the number of successes. (CO3) 2

2.d. Assuming the probability of male birth as ½, find the probability distribution of number of boys out of 5 births. Find the probability that a family of 5 children have at least one boy. (CO4) 2

2.e. Write short note on Haar wavelet and Continuous wavelet transform. (CO5) 2

SECTION B 30

3. Answer any five of the following:-

3-a. Find the mode from the following data: (CO1) 6

x	0-6	6-12	12-18	18-24	24-30	30-36	36-42
y	6	11	25	35	18	12	6

3-b. Find the Karl Pearson coefficient of skewness for the following data- (CO1) 6

x	10	11	12	13	14	15
y	2	4	10	8	5	1

3-c. To test the effectiveness of inoculation against cholera, the following table was obtained: 6

	Attacked	Not attacked	total
Inoculated	30	160	190
Not inoculated	140	460	600
Total	170	620	790

Use Chi-Square test to defend or refute the statement that the inoculation prevents attack from cholera. If the tabulated value is 3.841 at 5% level. (CO2)

3-d. The following table gives the number of accidents that took place in an industry during various days of the 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

Given that tabular value of Chi-Square at 5% LOS for 5 degree of freedom is 11.09. (CO2)

3.e. The joint probability distribution of two random variables X and Y is given by: 6
P(X=0, Y=1)=1/3, P(X=1,Y=-1)=1/3 and P(X=1, Y=1)=1/3
Find i) Marginal distribution of X and Y and
ii) conditional probability distribution of X given Y=1 (CO3)

3.f. Fit a Poisson distribution to the following data and theoretical frequencies. (CO4) 6

x	0	1	2	3	4
f	122	60	15	2	1

3.g. How many different words can be formed using all the letters of the world 6
ALLAHABAD
(i) When the wobbles occupy the even position.
(ii) Both L do not occur together. (CO5)

SECTION C 50

4. Answer any one of the following:-

4-a. An incomplete distribution of families according to their expenditure per week is given below. The median and mode for the distribution is ₹ 25 and ₹ 24 respectively. Calculate the missing frequencies. (CO1) 10

Expenditure	0-10	10-20	20-30	30-40	40-50
No. of families	14	?	27	?	15

4-b. Find the moment coefficient of Skewness and kurtosis for the following data: (CO1) 10

x	0-10	10-20	20-30	30-40	40-50

f	10	20	40	20	10

5. Answer any one of the following:-

5-a. Sample of sizes 10 and 14 were taken from two normal populations with SD 3.5 and 5.2. The sample means were found to be 20.3 and 18.6. Test whether the means of the two populations are the same at 5% LOS. The tabulated value is 2.07 at 5% LOS for 22 d.f. (CO2) 10

5-b. In a manufacturing process, the number of defectives found in the inspection of 20 lots of 100 samples is given below: 10

Lot No. :	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Defective:	5	4	3	5	4	6	9	15	11	6	7	6	3	5	4	2	8	7	6	4

Determine the control limits of P-chart and state whether the process is in control.. (CO2)

6. Answer any one of the following:-

6-a. The joint probability density function of two-dimensional random variable (X,Y) is given by- (CO3) 10

$$f(x,y) = \begin{cases} 6x^2y, & 0 < x < 1,\ 0 < y < 1 \\ 0, & \text{elsewhere} \end{cases}$$

(i) Verify that $\int_0^1 \int_0^1 f(x, y)\, dx\, dy = 1$

ii) Find

$$P\left(0 < X < \frac{3}{4}, \frac{1}{3} < Y < 2\right), P(X + Y < 1), P(X > Y) \text{ and } P(X < 1 \mid Y < 2)$$

6-b. Joint distribution of X and Y is given by $f(x, y) = 4xye^{-(x^2+y^2)}; x \geq 0, y \geq 0.$ Test whether X and Y are independent. For the above joint distribution, find the conditional density of X given by Y = y . (CO3) 10

7. Answer any one of the following:-

7-a. Prove that Poisson distribution is limiting case of Binomial distribution. (CO4) 10

7-b. In a distribution exactly Normal, 31% of the items are under 45 and 8% are over 64. What are the mean and Standard deviation of this Distribution? It is given that if 10

$$f(t) = \frac{1}{\sqrt{2\pi}} \int_0^t e^{\frac{-x^2}{2}} dx, f(0.5) = 0.19, f(1.4) = 0.42.$$

(CO4)

8. Answer any one of the following:-

8-a. Let A=R-{3} and B=R-{2}, consider the function f:A → B defined by $f(x) = \frac{x-2}{x-3}$. Is f one one and onto? justify your answer. (CO5) 10

8-b. Dev can hit a target 3 times in 6 shorts Pawan can hit the target 2 times in 6 shorts and Lakhan can hit the target 4 times in 4 shorts. What is the probability that at least 2 shorts hit the target? (CO5) 10