ANURAG Engineering College
(An Autonomous Institutión)
II B.Tech I Semester Supplementary Examinations, Jan/Feb-2024
PROBABILITY AND STATISTICS
(COMMON TO CIVIL & CSE)

Time: 3 Hours **Max. Marks: 75**

Section – A (Short Answer type questions) (25 Marks)
Answer All Questions

		Course Outcome	B.T Level	Marks
1.	The length of time X, required by a group of people to complete a particular task is a random variable, with probability density function given by $$f(x) = \{k(x - x^2), \quad when \quad 0 \le x \le 10,$$ $$= 0; \text{ otherwise}$$ What is the value k that makes $f(x)$ a probability density function?	CO1	L1	2M
2.	Consider a colour preference experiment, consists of total ten toys. All these toys are kept in a plastic box. It is assumed that all toys are identical except for colour—four are red, and six are white. A child is asked to select any two toys randomly. Determine the probability that child chooses the two red toys?	CO1	L2	3M
3.	Given a standard normal distribution, determine the area under the curve that lies to the right of $z = 1.84$. Draw a rough picture.	CO2	L1	2M
4.	In a certain industrial facility, accidents occur infrequently. It is known that the probability of an accident on any given day is 0.005 and accidents are in dependent of each other. What is the probability that in any given period of 400 days there will be an accident on one day?	CO2	L2	3M
5.	Explain the positive correlation and negative correlation with one-one real life example for each?	CO3	L1	2M
6.	In the following table, X is the tensile force applied to a steel specimen in thousands of pounds, and Y is the resulting elongation in thousands of an inch:	CO3	L2	3M

X	1	2	3	4	5
Y	14	33	40	63	76

Plot the data to verify that it is reasonable to assume that the regression of Y on X is linear.

		Course Outcome	B.T Level	Marks
7.	Explain type I and type II errors in brief.	CO4	L1	2M
8.	Determine the appropriate rejection regions for the large-sample test statistics z when A two-tailed test at the 5% significance level.	CO4	L2	3M
9.	A sample of 26 bulbs gives a mean life of 990 hours with a standard deviation of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours. Obtain t-test statistic for single mean.	CO5	L1	2M
10.	A company has developed a new cell phone battery. On average, the battery lasts 60 minutes on a single charge. The standard deviation is 4 minutes. Suppose the manufacturing department runs a quality control test. They randomly select 7 batteries. The standard deviation of the selected batteries is 6 minutes. What would be the Chi-square statistic represented by this test?	CO5	L2	3M

Section B (Essay Questions)
Answer all questions, each question carries equal marks.   **(5 X 10M = 50M)**

11. A survey was conducted at three airports L, M and N, in a particular city.   CO1   L3   10M
A) Based on this survey, it is concluded that airport L handles 45%, airport M handles 30%, and airport N handles 25% of all airline traffic. The detection rates for weapons at the three airports are 0.70, 0.85, and 0.90, respectively. Suppose that a passenger at one of the airports is found to be carrying a weapon through the boarding gate. Then:
i) Determine the probability that the passenger is using airport L.
ii) Determine the probability that the passenger is using airport M.

<div align="center">OR</div>

B) Let X be a random variable with density function defined by: CO1   L3   10M

$$f(x)=\begin{cases} \dfrac{x^2}{3} & -1<x<2 \\ 0 & elsewhere \end{cases}$$

Determine the expected value and variance of another function $g(X)=4X+3$.

12. The Director of a company specializing in public opinion surveys claims   CO2   L3   10M
A) that approximately 90% of all people to whom the agency sends questionnaires, respond by filling out and returning the questionnaire. If n = 15 such questionnaires are sent out and assume that the Director's claim is correct.
i) What is the probability that exactly eight of the questionnaires are filled out and returned?
ii) What is the probability that at least 10 of the questionnaires are filled out and returned?

<div align="center">OR</div>

B) The life span of oil-drilling bits depends on the types of rock and soil   CO2   L3   10M
that the drill encounters, but it is estimated that the mean length of life is 75 hours. Suppose an oil exploration company purchases drill bits that have a life span that is approximately normally distributed with a mean equal to 75 hours and a standard deviation equal to 10 hours. What is the probability that the company's drill bits will fail before 50 hours of use?

13. Consider the data as given in the following table: CO3   L3   10M
A)

x	50	40	30	20	10	7
y	1.25	2.35	3.15	4.25	5.30	6.25

i) Fit a straight line y = a + bx.
ii) Determine the value of x, when y equals to 5.80.

<div align="center">OR</div>

B) Ten competitors in a musical contest were ranked by 3 judges, A, B, and C in the following order:

Competitors	1	2	3	4	5	6	7	8	9	10
Ranked by A	1	6	5	10	3	2	4	9	7	8
Ranked by B	3	5	8	4	7	10	2	1	6	9
Ranked by C	6	4	9	8	1	2	3	10	5	7

Using rank correlation method, determine which pair of judges has the nearest approach to common liking in music.

CO3   L3   10M

14. Let p be the probability that a coin will fall head in a single toss in order
A) to test H_0: p=1/2 against H_1: p=3/4. The coin is tossed 5 times and H_0 is rejected if more than 3 heads are obtained. Determine the probability of type I and type II error and power of the test.

CO4   L3   10M

OR

B) Studying the flow of traffic at two busy intersections between 4 PM to 6 PM, it was found that on 40 weekdays there were on an average 247.3 cars approaching the first intersection from the south that made left turns, while 30 week days there were on the average 254.1 cars approaching the second intersection from the south that made left turns. The corresponding sample standard deviations are 15.2 and 18.7. Test the null hypothesis $\mu_1 - \mu_2 = 0$ against the alternative hypothesis $\mu_1 - \mu_2 \neq 0$ at the level of significance of $\alpha = 0.01$.

CO4   L3   10M

15. The heights of 10 students of a particular class are found to be 70, 67,
A) 62, 68, 61, 68, 70, 64, 64, 66 inches. Is it reasonable to believe that the average height is greater than 64 inches? Test at 5% significance level, assuming that for 9 degrees of freedom, $P(t > 1.83) = 0.05$.

CO5   L3   10M

OR

B) A researcher wanted to analyse whether the mean housing prices are the same regardless of the three crowded places where they are located. A random samples of the prices (Thousands of Dollars) at which the houses are being purchased at all the three areas are given below:

Observation	Low	Moderate	High
1	120	61	40
2	68	59	55
3	40	110	73
4	95	75	45
5	83	80	64

Construct the analysis of variance table for this experiment.

CO5   L3   10M