INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**PROBABILITY AND STATISTICS**				
Course Code	**AHSC08**				
Program	B.Tech				
Semester	TWO				
Course Type	Foundation				
Regulation	**IARE – R20**				
Course Structure	**Theory**			**Theory**	
	Lectures	**Lectures**	**Lectures**	**Laboratory**	**Laboratory**
	3	1	4	-	-
Course Coordinator	Mr. Ch Chaitanya, Assistant Professor				

COURSE OBJECTIVES:

The course will enable the students to learn:	
I	The theory of random variables, basic random variate distributions and their applications.
II	The Methods and techniques for quantifying the degree of closeness among two or more variables and linear regression analysis.
III	The Estimation statistics and Hypothesis testing which play a vital role in the assessment of the quality of the materials, products and ensuring the standards of the engineering process.
IV	The statistical tools which are essential for translating an engineering problem into probability model.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
	Course Outcomes	**Knowledge Level (Bloom's Taxonomy)**
CO 1	**Explain** the concept of random variables and types of random variables by using suitable real time examples.	Understand
CO 2	**Calculate** the expected values, variances of the discrete and continuous random variables for making decisions under randomized probabilistic conditions.	Apply

CO 3	**Interpret** the parameters of random variate Probability distributions such as Binomial, Poisson and Normal distribution by using their probability functions, expectation and variance.	Understand
CO 4	**Apply** the concepts of discrete and continuous probability distribution and CLT for solving real time problems under probabilistic conditions.	Apply
CO 5	**Interpret** the results of Bivariate Regression as well as Correlation Analysis for statistical forecasting.	Understand
CO 6	**Identify** the role of types of statistical hypotheses, types of errors, sampling distributions of means and confidence intervals in hypothesis testing	Apply
CO 7	**Appl y** tests of hypotheses for both large and small samples in making decisions over statistical claims.	Apply
CO 8	**Test for** the assessment of goodness of fit of the given probability distribution model by using Chi-square distribution.	Analyze
CO 9	**Make Use o f**R software package in computing confidence intervals, Regression analysis and hypothesis testing.	Apply
CO 10	**Select** appropriate statistical methods for solving real-time engineering problems governed by laws of probability.	Apply

MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 7	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 8	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 9	1	-	-	1	3	-	-	-	-	-	-	-	-	-	-
CO 10	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	10	4		5	3										
AVERAGE	**1**	**2**		**1**	**3**										

TUTORIAL QUESTION BANK

MODULE - I				
PROBABILITY AND RANDOM VARIABLES				
PART - A (SHORT ANSWER QUESTIONS)				
S No	**Questions**	**Blooms Taxonomy Level**	**How does this Subsume the level**	**Course Outcome**
1	State the classical definition of probability?	Remember	---	CO 1
2	If E(X) = 6 and $E(X^2) = 100$ find the variance.	Remember	---	CO 1
3	If three coins re thrown at a time and X denotes the random variable which is defined as X(x) = no of heads, write its probability distribution table.	Remember	---	CO 1
4	If E(X) = 7, $E(X^2) = 40$, find the value of $E(5X^2 - 11X + 8)$	Remember	---	CO 1
5	State the definitions of discrete and continuous random variables with a suitable example.	Remember	---	CO 1
6	List out the important Properties of probability density function.	Remember	---	CO 2
7	Find the probability distribution of getting number tails if we toss three coins calculate mean.	Remember	---	CO 2
8	State the definition of mathematical expectation of a probability distribution function	Remember	---	CO 3
9	State the definition of the Mean and Variance of a probability mass function.	Remember	---	CO 3
10	State the definition of the Mean and Variance of a probability density function.	Remember	---	CO 3
11	Find the probability distribution for sum of scores on dice if we throw two dice.	Remember	---	CO 2, CO 3
12	Out of 24 mangoes, 6 mangoes are rotten. If we draw two mangoes. Obtain probability distribution of number of rotten mangoes that can be drawn. also find the expectation	Remember	---	CO 2, CO 3
13	If X is a random variable then show that $E[X + K] = E(X) + K$ where 'K' constant.	Understand	Learner to Explain the concept of random variable and Prove $E[X + K] = E(X) + K$, where 'K' constant.	CO 3
14	Show that $\sigma^2 = E(X^2) - \mu^2$.	Understand	Learner to Explain the concept of variance of a random variable and Prove $\sigma^2 = E(X^2) - \mu^2$	CO 3
15	State the definitions of the probability mass function and probability density of random variables.	Remember	---	CO 2
16	If X is Discrete Random variable then show that $V[aX + b] = a^2V(X)$.	Understand	Learner to Explain the concept of variance of a random variable and Prove that $V[aX + b] = a^2V(X)$.	CO 3

<table>
<tr><td>17</td><td>State the classical definition of probability. If a fair coin is tossed six times. calculate the probability of getting four heads.</td><td>Understand</td><td>Learner to recall the concept of classical probability and explain its practical importance and use it to calculate the probability of getting four heads when a fair coin is tossed for 6 times.</td><td>CO 1</td></tr>
<tr><td>18</td><td>State the definition of different types of random variables with example.</td><td>Remember</td><td>---</td><td>CO 2</td></tr>
<tr><td>19</td><td>outline the classical definition of probability. A coin is tossed 9 times. calculate the probability of getting 5 heads.</td><td>Understand</td><td>Learner to recall the concept of classical probability and explain its practical importance and use it to calculate the probability of getting four heads when a fair coin is tossed for 9 times.</td><td>CO 1</td></tr>
<tr><td>20</td><td>State the definition of random variable with an example.</td><td>Remember</td><td>---</td><td>CO 2</td></tr>
<tr><td colspan="5">PART-B (LONG ANSWER QUESTIONS)</td></tr>
<tr><td>1</td><td>Let X denotes the maximum of the two numbers that appear when a pair of fair dice is thrown once. calculate the
(i) Discrete probability distribution
(ii) Expectation (iii) Variance.</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 1</td></tr>
<tr><td>2</td><td>Let X denotes the number of heads in a single toss of 4 fair coins. Determine $P(X<2)$ $ii)\ P(1<X\leq 3)$</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 1</td></tr>
<tr><td>3</td><td>A random variable X has the following probability function.
<table><tr><td>X</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>P(X)</td><td>0.3</td><td>0.1</td><td>0.1</td><td>0.3</td><td>0.2</td></tr></table>Calculate (i) Expectation (ii) variance (iii) Standard deviation.</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 1</td></tr>
<tr><td>4</td><td>Find the mean and variance of the uniform probability distribution given by $P(x)=\frac{1}{n}\ for\ x=1,2,3,\dots,n.$</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 1</td></tr>
</table>

<table>
<tr><td>5</td><td>A random variable X has the following probability function.<table><tr><td>X</td><td>8</td><td>12</td><td>16</td><td>20</td><td>24</td></tr><tr><td>P(X)</td><td>1/8</td><td>1/6</td><td>3/8</td><td>¼</td><td>1/12</td></tr></table>Calculate (i) Expectation (ii) variance (iii) Standard deviation.</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 1</td></tr>
<tr><td>6</td><td>The length of time (in minutes) that a certain lady speaks on the telephone is found to be random phenomenon, with a probability function specified by the function $f(x)=\begin{cases} Ae^{-\frac{x}{5}}, x\geq 0 \\ 0, otherwise \end{cases}$. (i) Calculate the value of A that makes f(x) a probability density function. (ii) calculate the probability that she will take over the phone is more than 20 minutes?</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>7</td><td>If X denote the sum of the two numbers that appear when a pair of fair dice is tossed. Estimate the (i) Distribution function (ii) Mean and (iii) Variance.</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>8</td><td>Is the function defined as follows a density function $f(x)=\begin{cases} e^{-x}, x\geq 0 \\ 0, x<0 \end{cases}$. If so, estimate the probability that the variate having This density will fall in the interval (1, 2)? Calculate the cumulative probability F (2)?</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>9</td><td>If probability density function $f(x)=\begin{cases} Kx^3, 0\leq x\leq 3 \\ 0, elsewhere \end{cases}$. Calculate the value of K and Calculate the probability between x=1/2 and x=3/2.</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>10</td><td>A random variable x has the following probability function:<table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>P(x)</td><td>0</td><td>k</td><td>2k</td><td>2k</td><td>3k</td><td>k^2</td><td>$2k^2$</td></tr></table>Calculate (i) k (ii) P(x<6) (iii) $P(X\geq 6)$</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 3</td></tr>
</table>

<table>
<tr><td>11</td><td>Let X denotes the minimum of the two numbers that appear when a pair of fair dice is thrown once. calculate the
(i) Discrete probability distribution
(ii) Expectation (iii) Variance.</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>12</td><td>A random variable X has the following probability function:
<table><tr><td>X</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>P(x)</td><td>k</td><td>0.1</td><td>k</td><td>0.2</td><td>2k</td><td>0.4</td><td>2k</td></tr></table>Then Calculate (i) k (ii) mean (iii) variance.</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>13</td><td>A continuous random variable has the probability density function
$f(x)=\begin{cases} kxe^{-\lambda x}, \ for\ x \geq 0, \lambda > 0 \\ 0, otherwise \end{cases}$
Evaluate (i) Mean (ii) Variance by finding k.</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>14</td><td>If the Probability density function of random variable is $f(x)=k(1-x^2), 0 < x < 1$, then Calculate
(i) k (ii) P (0.1 < x< 0.2) (iii) P (x > 0.5).</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>15</td><td>A random variable X has the following probability function.
<table><tr><td>X</td><td>4</td><td>5</td><td>6</td><td>8</td></tr><tr><td>P(X)</td><td>0.1</td><td>0.3</td><td>0.4</td><td>0.2</td></tr></table>Calculate (i) Expectation (ii) variance (iii) Standard deviation.</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>16</td><td>If X is a Continuous random variable whose density function is
$f(x) = \begin{cases} x & if\ 0 < x < 1 \\ 2-x & if\ 1 \leq x < 2 \\ 0 & elsewhere \end{cases}$
Evaluate $E(\ 25X^2 + 30X - 5)$.</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>17</td><td>The cumulative distribution function for a continuous random variable X is $F(x)=\begin{cases} 1-e^{-2x}, \ x \geq 0 \\ 0, \ x < 0 \end{cases}$</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability distributive function</td><td>CO 3</td></tr>
</table>

	Evaluate (i) density function f(x) (ii) Mean and (iii) Variance of the density function.		of a continuous random variable and use it to calculate the continuous range probabilities, expected values.	
18	Two coins are tossed simultaneously. Let X denotes the number of heads then Calculate $E[X]\ ,E(X^2), E(X^3)\ \ ,V(X)$. .	Apply	Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.	CO 3
19	Is the function defined by $f(x)=\begin{cases} 0, & x<2 \\ \frac{1}{18}(2x+3), & 2\le x\le 4 \\ 0 & ,x>4 \end{cases}$ a probability density function? Estimate the probability that a variate having f(x) as density function will fall in the interval $2\le x\le 3$.	Apply	Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.	CO 3
20	The probability density function of a random variable X is $f(x) = \frac{K}{x^2+1}\ \ ,-\infty\ < x\ <\ \infty$. Calculate K and the distribution function F(x).	Apply	Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.	CO 3
PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				
1	The probability density function of a random variable X is $f(x) = \begin{cases} 3x^2\ , & 0\ < x\ <\ 1 \\ 0, & otherwise \end{cases}$. Calculate the value of a, if $P(a \le x \le 1) = \frac{19}{81}$.	Apply	Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.	CO 1
2	The daily consumption of electric power (in millions of kW-hours) is a random variable having the probability density function $f(x)\begin{cases} = \frac{1}{9}xe^{-x/3}, & x>0 \\ 0, & otherwise \end{cases}$ If the total production is 12 million kW-hours, determine the probability that there is a power cut on a given day.	Apply	Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.	CO 1
3	A fair coin is tossed until a head or five tails occurs. Find the expected number E of tosses of the coin.	Apply	Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a	CO 1

<table>
<tr><td></td><td></td><td></td><td>discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td></td></tr>
<tr><td>4</td><td>A fair die is tossed. Let the random variable X denote the twice the number appearing on the die:(i) construct the probability distribution of X hence find Mean and Variance.</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 1</td></tr>
<tr><td>5</td><td>If f(x) =$k\,e^{-|x|}$ is probability density function in the interval, x is a real, then evaluate ii) Mean iii) Variance iv) $P(0 < X < 4\,)$. By finding k.</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.</td><td>CO 1</td></tr>
<tr><td>6</td><td>The function $f\,(x)= Ax^2$, in $0< x <1$ is valid probability density function then Calculate the value of A.</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.</td><td>CO 1</td></tr>
<tr><td>7</td><td>The density function of a random variable X is $f(x)=\begin{cases} e^{-x} & ,x\geq 0 \\ 0 & ,otherwise \end{cases}$ evaluate $E[X]$, $E(X^2)$, $V(X)$.
.</td><td>Apply</td><td>Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.</td><td>CO 3</td></tr>
<tr><td>8</td><td>If $E[X]$ = 10, $V(X) = 1$, then Calculate $E(2X(X + 10)$.</td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the expected values.</td><td>CO 3</td></tr>
<tr><td>9</td><td>A discrete random variable X has the following probability distribution
Calculate (i) k (ii) P(X<3) (iii)P (X > 5).
<table>
<tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>P(x)</td><td>2k</td><td>4k</td><td>6k</td><td>8k</td><td>10k</td><td>12k</td><td>14k</td><td>4k</td></tr>
</table></td><td>Apply</td><td>Learner to recall the concept of a discrete random variable and explain the properties of probability mass function of a discrete random variable and use it to calculate the discrete range probabilities, expected values.</td><td>CO 3</td></tr>
</table>

10	For the continuous random variable X whose probability density function is given by $f(x)=\begin{cases} cx(2-x), 0\le x\le 2 \\ 0, otherwise \end{cases}$ Calculate c, mean and variance of X.	Apply	Learner to recall the concept of a continuous random variable and explain the properties of probability density function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.	CO 3
MODULE - II				
PROBABILITY DISTRIBUTIONS				
PART - A (SHORT ANSWER QUESTIONS)				
1	20% of items produced from a goods factory are defective. If we choose 5 items randomly then Calculate the probability of non-defective item.	Apply	Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.	CO 5
2	The probability if no misprint in a book is e^{-4}. Calculate probability that a page of book contains exactly two misprints.	Apply	Learner to recall the definition of Poisson distribution and explain the properties of Poisson distribution and use Poisson formula to calculate the required probabilities.	CO 5
3	Assume that 50% of all engineering students are good in Mathematics. Determine the probability that among 18 engineering students exactly 10 are good in Mathematics.	Apply	Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.	CO 5
4	If the probability of a defective bolt is 0.2, Calculate (i) mean (ii) standard deviation for the bolts in a total of 400.	Apply	Learner to recall the definition of Poisson distribution and explain the properties of Poisson distribution and use Poisson formula to calculate the required probabilities.	CO 5
5	Interpret the properties of Binomial distribution.	Understand	Learner to Define the binomial distribution and explain its properties and parameters.	CO 4
6	If n=4, p=0.5 then Calculate standard deviation of the binomial distribution.	Apply	Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.	CO 5
7	Explain the properties of Poisson distribution.	Understand	Learner to Define the Poisson distribution and explain its properties and parameters.	CO 4
8	Build the binomial distribution for which the mean is 4 and variance 3	Apply	Learner to recall the definition of Binomial distribution and explain the properties of	CO 5

			Binomial distribution and use Binomial formula to calculate the required parameters.	
9	If X is normally distributed with mean 2 and variance 0.1, then Calculate $P\ (\lvert x-2\rvert \geq 0.01)$?	Apply	Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the required probabilities.	CO 5
10	If X is Poisson variate such that P(X=1) = 24P(X=3) then Calculate the mean.	Apply	Learner to recall the definition of Poisson distribution and explain the properties of Poisson distribution and use Poisson formula to calculate the mean.	CO 5
11	Explain the properties of normal distribution Normal distribution.	Understand	Learner to Define the Normal distribution and explain its properties and parameters.	CO 4
12	Interpret the properties of Binomial distribution. Derive the recurrence relation for binomial distribution.	Understand	Learner to Define the binomial distribution and explain its properties and use it to derive the recurrence relation.	CO 4
13	The mean and variance of a binomial distribution are 4 and 4/3 respectively. Then Calculate P(x=1).	Apply	Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.	CO 5
14	In eight throws of a die 5 or 6 is considered a success. Calculate the mean number of success	Apply	Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.	CO 5
15	If a bank received on the average 6 bad cheques per day, Calculate the probability that it will receive 4 bad cheques on any given day.	Apply	Learner to recall the definition of Poisson distribution and explain the properties of Poisson distribution and use Poisson formula to calculate the required probabilities.	CO 5
16	Illustrate the properties of the Normal curve.	Understand	Learner to recall the definition of Normal distribution and Illustrate the properties of Normal curve.	CO 4
17	State the formulae of Mean, Variance of Poisson distribution	Remember	---	CO 4
18	State the formulae of mode of a Binomial distribution.	Remember	---	CO 4
19	State the formulae of mean, variance of Binomial distribution.	Remember	---	CO 4

<table>
<tr><td>20</td><td>Explain the properties of Poisson distribution. Derive the recurrence relation for the Poisson distribution.</td><td>Understand</td><td>Learner to Define the Poisson distribution and explain its properties and use it to derive the recurrence relation.</td><td>CO 4</td></tr>
<tr><td colspan="5">PART-B (LONG ANSWER QUESTIONS)</td></tr>
<tr><td>1</td><td>Out of 20 tape recorders 5 are defective. Calculate the standard deviation of defective in the sample of 10 randomly chosen tape recorders. Calculate (i) P(X=0) (ii) P(X=1) (iii) P(X=2) (iv) $P(0 < X < 4)$.</td><td>Apply</td><td>Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.</td><td>CO 5</td></tr>
<tr><td>2</td><td>A car-hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 1.5. Calculate the proportion of days (i) on which there is no demand (ii) on which demand is refused.</td><td>Apply</td><td>Learner to recall the definition of Poisson distribution and explain the properties of Poisson distribution and use Poisson formula to calculate the required probabilities.</td><td>CO 5</td></tr>
<tr><td>3</td><td>The average number of phone calls per minute coming into a switch board between 2 P.M. and 4 P.M. is 2.5. Estimate the probability that during one particular minute (i) 4 or fewer calls (ii) more than 6 calls.</td><td>Apply</td><td>Learner to recall the definition of Poisson distribution and explain the properties of Poisson distribution and use Poisson formula to calculate the required probabilities.</td><td>CO 5</td></tr>
<tr><td>4</td><td>In 1000 sets of trials per an event of small probability the frequencies f of the number of x of successes are
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>Total</td></tr>
<tr><td>f</td><td>305</td><td>365</td><td>210</td><td>80</td><td>28</td><td>9</td><td>2</td><td>1</td><td>1000</td></tr>
</table>
Calculate the expected frequencies Using Poisson.</td><td>Apply</td><td>Learner to recall the definition of Poisson distribution and explain the properties of Poisson distribution and use Poisson formula to calculate the required frequencies.</td><td>CO 5</td></tr>
<tr><td>5</td><td>For a normally distributed variate with mean 1 and standard deviation 3.
Calculate i) $P(3.43 \leq X \leq 6.19)$
ii) $P(-1.43 \leq X \leq 6.19)$.</td><td>Apply</td><td>Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the required probabilities.</td><td>CO 5</td></tr>
<tr><td>6</td><td>If X is a normal variate with mean 30 and standard deviation 5. Calculate the probabilities that i) $P(26 \leq X \leq 40)$
ii) $P(X \geq 45)$.</td><td>Apply</td><td>Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the required probabilities.</td><td>CO 5</td></tr>
<tr><td>7</td><td>4 coins are tossed 160 times. Fit the Binomial distribution of getting number of heads.
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>f</td><td>5</td><td>22</td><td>65</td><td>60</td><td>8</td></tr>
</table></td><td>Apply</td><td>Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required frequencies.</td><td>CO 5</td></tr>
</table>

8	The mean weight of 500 male students at a certain college is 75kg and the standard deviation is 7kg. Assuming that the weights are normally distributed Calculate how many students weight (i) Between 60 and 78 kg (ii) more than 92kg.	Apply	Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the required probabilities.	CO 5
9	The mean and standard deviation of the box obtained by 1000 students in an examination are respectively 34.5 and 16.5. Assuming the normality of the distribution. Calculate the approximate number of students expected to obtain marks between 30 and 60.	Apply	Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the required probabilities.	CO 5
10	If the masses of 300 students are normally distributed with mean 68 kgs and standard deviation 3 kgs. Calculate How many students have masses (i) greater than 72 kg (ii) less than or equal to 64 kg (iii) between 65 and 71 kg inclusive.	Apply	Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the required probabilities.	CO 5
11	Out of 800 families with 5 children each, calculate how many would you expect to have (i)3 boys (ii)5girls (iii)either 2 or 3 boys? Assume equal probabilities for boys and girls.	Apply	Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.	CO 5
12	If a Poisson distribution is such that $P(X=1)=\frac{3}{2}P(X=3)$ then Calculate (i) $P(X \geq 1)$ (ii) $P(X \leq 3)$ (iii) $P(2 \leq X \leq 5)$.	Apply	Learner to recall the definition of Poisson distribution and explain the properties of Poisson distribution and use Poisson formula to calculate the required probabilities.	CO 5
13	Average number of accidents on any day on a national highway is 1.8. Calculate the probability that the number of accidents is (i) at least one (ii) at most one.	Apply	Learner to recall the definition of Poisson distribution and explain the properties of Poisson distribution and use Poisson formula to calculate the required probabilities.	CO 5
14	In a Normal distribution, 7% of the item are under 35 and 89% are under 63. Calculate the mean and standard deviation of the distribution.	Apply	Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the mean and variance.	CO 5
15	A shipment of 20 tape recorders contains 5 defectives Calculate the standard deviation of the probability distribution of the number of defectives in a sample of 10 randomly chosen for inspection.	Apply	Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.	CO 5
16	1000 students have written an examination with the mean of test is 35 and standard deviation is 5. Assuming the distribution to be normal Calculate i) How many students marks like between 25 and 40?	Apply	Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal	CO 5

<table>
<tr><td></td><td>ii) How many students get more than 40?
iii) How many students get below 20?
iv) How many students get more than 50.</td><td></td><td>distribution formula to calculate the required probabilities.</td><td></td></tr>
<tr><td>17</td><td>Calculate the expected frequencies Using Binomial Distribution to the following data<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>f</td><td>2</td><td>14</td><td>20</td><td>34</td><td>22</td><td>8</td></tr></table></td><td>Apply</td><td>Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required frequencies.</td><td>CO 5</td></tr>
<tr><td>18</td><td>Show that the recurrence relation for the Poisson distribution is $$P(x) = \frac{\lambda}{x} \cdot P(x-1)$$</td><td>Understand</td><td>Learner to Define the Poisson distribution and explain its properties and use it to derive the recurrence relation.</td><td>CO 4</td></tr>
<tr><td>19</td><td>The life of electronic tubes of a certain type may be assumed to be normal distributed with mean 155 hours and standard deviation 19 hours. Calculate the probability that the life of a randomly chosen tube is
(i) between 136 hours and 174 hours.
(ii) less than 117 hours
(iii) will be more than 195 hours</td><td>Apply</td><td>Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the required probabilities.</td><td>CO 5</td></tr>
<tr><td>20</td><td>The probability that a man hitting a target is 1/3. If he fires 5 times, the probability that he fires
(i) At most 3 times (ii) At least 2 times</td><td>Apply</td><td>Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.</td><td>CO 5</td></tr>
<tr><td colspan="5">PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)</td></tr>
<tr><td>1</td><td>Show that the Poisson distribution is a limiting case of Binomial distribution.</td><td>Understand</td><td>Learner to recall the definitions of Binomial as well as Poisson distributions and outline the proof of the theorem that Poisson distribution is a limiting case of Binomial distribution.</td><td>CO 4</td></tr>
<tr><td>2</td><td>Explain the properties of normal distribution. Calculate the variance of the Poisson distribution.</td><td>Understand</td><td>Learner to recall the definition of Poisson distribution and outline the proof of variance of Poisson distribution</td><td>CO 4</td></tr>
<tr><td>3</td><td>Explain the properties of normal distribution. Determine the Mode in Normal distribution.</td><td>Understand</td><td>Learner to recall the definition of Normal distribution and Illustrate the properties of Normal curve and derive the mode of normal distribution.</td><td>CO 4</td></tr>
<tr><td>4</td><td>Explain the properties of normal distribution. Calculate the median of the Normal distribution.</td><td>Understand</td><td>Learner to recall the definition of Normal distribution and Illustrate the properties of Normal curve and derive the median of normal distribution.</td><td>CO 4</td></tr>
</table>

<table>
<tr><td>5</td><td>The marks obtained in Statistics in a certain examination found to be normally distributed. If 15% of the students greater than or equal to 60 marks, 40% less than 30 marks. Calculate the mean and standard deviation.</td><td>Apply</td><td>Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the mean and standard deviation.</td><td>CO 5</td></tr>
<tr><td>6</td><td>The variance and mean of a binomial variable X with parameters n and p are 4 and 3. Calculate i) $P(X=1)$ ii) $P(X\geq 1)$ iii) $P(0<X<3)$.</td><td>Apply</td><td>Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required probabilities.</td><td>CO 5</td></tr>
<tr><td>7</td><td>Calculate the expected frequencies of the Binomial distribution to the following data
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>f</td><td>13</td><td>25</td><td>52</td><td>58</td><td>32</td><td>16</td><td>4</td></tr>
</table></td><td>Apply</td><td>Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required frequencies.</td><td>CO 5</td></tr>
<tr><td>8</td><td>Explain the properties of normal distribution. Obtain the Mean of Normal distribution.</td><td>Understand</td><td>Learner to recall the definition of Normal distribution and Illustrate the properties of Normal curve and derive the mean of normal distribution.</td><td>CO 5</td></tr>
<tr><td>9</td><td>If 7% of the students scored marks less than 35 and 11% of the students scored above 63 marks calculate the mean and variance assuming normality.</td><td>Apply</td><td>Learner to recall the definition of Normal distribution and explain the properties of Normal distribution and use Normal distribution formula to calculate the mean and standard deviation.</td><td>CO 5</td></tr>
<tr><td>10</td><td>Explain the properties of Binomial distribution. Obtain the formula for mean of Binomial Distribution.</td><td>Understand</td><td>Learner to recall the definition of Binomial distribution and Outline the proof of mean of binomial distribution.</td><td>CO 5</td></tr>
<tr><td colspan="5">MODULE - III</td></tr>
<tr><td colspan="5">CORRELATION AND REGRESSION</td></tr>
<tr><td colspan="5">PART - A (SHORT ANSWER QUESTIONS)</td></tr>
<tr><td>1</td><td>State the definition of correlation coefficient.</td><td>Remember</td><td>--</td><td>CO 6</td></tr>
<tr><td>2</td><td>List out the types of correlation.</td><td>Remember</td><td>--</td><td>CO 6</td></tr>
<tr><td>3</td><td>Outline the properties of coefficient correlation. Given $n = 12, \sigma_x = 2.5, \sigma_y = 3.6$ and sum of the product of deviation from the mean of X and Y is 64 Calculate the correlation co-efficient.</td><td>Understand</td><td>Learner to recall the concept of coefficient of correlation and explain its practical importance and use the formula to calculate the coefficient of correlation for the given data.</td><td>CO 6</td></tr>
<tr><td>4</td><td>State the formula of rank correlation coefficient.</td><td>Remember</td><td>--</td><td>CO 6</td></tr>
</table>

5	State the properties of correlation coefficient.	Remember	--	CO 6
6	Outline the properties of coefficient correlation. If $\sum XY = 216, \sum X^2 = 102, \sum Y^2 = 471$ then Calculate correlation coefficient.	Understand	Learner to recall the concept of coefficient of correlation and explain its practical importance and use the formula to calculate the coefficient of correlation for the given data.	CO 6
7	Outline the properties of coefficient correlation. Given $n=10, \sigma_x = 5.4, \sigma_y = 6.2$ and sum of product of deviations from the mean of X and Y is 66 Calculate the correlation co-efficient.	Understand	Learner to recall the concept of coefficient of correlation and explain its practical importance and use the formula to calculate the coefficient of correlation for the given data.	CO 6
8	State the properties of rank correlation coefficient.	Remember	--	CO 6
9	Outline the properties of coefficient correlation. From the following data calculate (i) correlation c coefficient (ii) standard deviation of y. $b_{xy} = 0.85$, $b_{xy} = 0.89$, $\sigma_x = 3$.	Understand	Learner to recall the concept of coefficient of correlation and explain its practical importance and use the formula to calculate the coefficient of correlation for the given data.	CO 6
10	Outline the properties of coefficient correlation. If N=8, $\sum X = 544, \sum Y = 552, \sum XY = 37560$ then Calculate COV (X, Y).	Understand	Learner to recall the concept of coefficient of correlation and explain its practical importance and use the formula to calculate the covariance for the given data.	CO 6
11	Outline the properties of coefficient correlation. The equations of two regression lines are 7x-16y+9=0, 5y-4x-3=0. Calculate the coefficient of correlation.	Understand	Learner to recall the concept of coefficient of correlation and explain its practical importance and use the formula to calculate the coefficient of correlation for the given data.	CO 6
12	State the normal equations for regression lines?	Remember	---	CO 6
13	State the formula of multiple correlation.	Remember	---	CO 6
14	Outline the formula of coefficient multiple correlation. *If* $r_{12} = 0.5, r_{13} = 0.3, r_{23} = 0.45$ then Calculate multiple correlation coefficient $R_{1.23}$.	Understand	Learner to recall the concept of coefficient of multiple correlation and explain its practical importance and use it to calculate the coefficient of multiple correlation for the given data.	CO 6
15	State the definition of the regression equation of X_1 on X_2 and X_3?	Remember	---	CO 6
16	State the definition of multiple regressions.	Remember	---	CO 6
17	Outline the formula of coefficient multiple correlation. If $r_{12} = 0.77, r_{13} = 0.72, r_{23} = 0.52$ Calculate the multiple correlation coefficient $R_{1.23.}$	Understand	Learner to recall the concept of coefficient of multiple correlation and explain its practical importance and use it	CO 6

<table>
<tr><td></td><td></td><td></td><td>to calculate the coefficient of multiple correlation for the given data.</td><td></td></tr>
<tr><td>18</td><td>State the properties of regression lines.</td><td>Remember</td><td>---</td><td>CO 6</td></tr>
<tr><td>19</td><td>List the differences between correlation and regression.</td><td>Remember</td><td>---</td><td>CO 6</td></tr>
<tr><td>20</td><td>Outline the formula of coefficient multiple correlation.
If $r_{12} = 0.8$, $r_{13} = 0.5$ and $r_{23} = 0.3$ then Calculate multiple correlation coefficient $R_{1.23}$.</td><td>Understand</td><td>Learner to recall the concept of coefficient of multiple correlation and explain its practical importance and use it to calculate the coefficient of multiple correlation for the given data.</td><td>CO 6</td></tr>
<tr><td colspan="5">PART-B (LONG ANSWER QUESTIONS)</td></tr>
<tr><td>1</td><td>Interpret the properties of rank correlation coefficient. A random sample of 5 college students is selected and their grades in mathematics and statistics are found to be
<table>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Mathematics</td><td>85</td><td>60</td><td>73</td><td>40</td><td>90</td></tr>
<tr><td>Statistics</td><td>93</td><td>75</td><td>65</td><td>50</td><td>80</td></tr>
</table>
Calculate Spearman's rank correlation coefficient.</td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using spearman’s rank coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>2</td><td>Interpret the properties of correlation coefficient. Calculate the coefficient of correlation from the following data
<table>
<tr><td>x</td><td>12</td><td>9</td><td>8</td><td>10</td><td>11</td><td>13</td><td>7</td></tr>
<tr><td>y</td><td>14</td><td>8</td><td>6</td><td>9</td><td>11</td><td>12</td><td>13</td></tr>
</table></td><td>Understand</td><td>Learner to recall the concept of coefficient of correlation and Interpret the degree of closeness between the given two variables by using Pearson’s coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>3</td><td>Explain the properties of rank correlation coefficient. The following data gives the marks in obtained by 10 students in accountancy and statistics.
<table>
<tr><td>R</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>A</td><td>45</td><td>70</td><td>65</td><td>30</td><td>90</td><td>40</td><td>50</td><td>75</td><td>85</td><td>60</td></tr>
<tr><td>S</td><td>35</td><td>90</td><td>70</td><td>40</td><td>95</td><td>40</td><td>80</td><td>80</td><td>80</td><td>50</td></tr>
</table>
Where R: roll number, A: accountancy, S: statistics. Calculate the coefficient of correlation.</td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using spearman’s rank coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>4</td><td>Interpret the properties of correlation coefficient. Calculate the Karl Pearson’s coefficient of correlation from the following data.
<table>
<tr><td>W</td><td>100</td><td>101</td><td>102</td><td>102</td><td>100</td><td>99</td><td>97</td><td>98</td><td>96</td></tr>
<tr><td>C</td><td>98</td><td>99</td><td>99</td><td>97</td><td>95</td><td>92</td><td>95</td><td>94</td><td>90</td></tr>
</table>
Where W: wages and C: cost of living.</td><td>Understand</td><td>Learner to recall the concept of coefficient of correlation and Interpret the degree of closeness between the given two variables by using Pearson’s coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>5</td><td>Explain the properties of rank correlation coefficient. Calculate a suitable coefficient of correlation for the following data:
<table>
<tr><td>F</td><td>15</td><td>18</td><td>20</td><td>24</td><td>30</td><td>35</td><td>40</td><td>50</td></tr>
<tr><td>P</td><td>85</td><td>93</td><td>95</td><td>105</td><td>120</td><td>130</td><td>150</td><td>160</td></tr>
</table></td><td>Understand</td><td>Learner to recall the concept of coefficient of correlation and Interpret the degree of closeness between the given two variables by using Pearson’s coefficient of correlation.</td><td>CO 6</td></tr>
</table>

<table>
<tr><td></td><td>Where F: Fertilizer used(tones) and P: Productivity (tones)</td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Explain the properties of correlation coefficient. The following table give the distribution of the total population and those who are totally partially blind among them. Calculate out if there is any relation between age and blindness.
<table>
<tr><td>A</td><td>0-10</td><td>10-20</td><td>20-30</td><td>30-40</td><td>40-50</td><td>50-60</td><td>60-70</td><td>70-80</td></tr>
<tr><td>N</td><td>100</td><td>60</td><td>40</td><td>36</td><td>24</td><td>11</td><td>6</td><td>3</td></tr>
<tr><td>B</td><td>55</td><td>40</td><td>40</td><td>40</td><td>36</td><td>22</td><td>18</td><td>15</td></tr>
</table>
Where A: age intervals, N: No of persons in thousands and B: no of blind persons.</td><td>Understand</td><td>Learner to recall the concept of coefficient of correlation and Interpret the degree of closeness between the given two variables by using Pearson’s coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>7</td><td>Interpret the properties of rank correlation coefficient. Following are the ranks obtained by 10 students in two subjects, Statistics and Mathematics. Estimate To what extent the knowledge of the students in two subjects is related?
<table>
<tr><td>S</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>M</td><td>2</td><td>4</td><td>1</td><td>5</td><td>3</td><td>9</td><td>7</td><td>10</td><td>6</td><td>8</td></tr>
</table></td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using spearman’s rank coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>8</td><td>Explain the properties of rank correlation coefficient. The ranks of 16 students in Mathematics and Statistics are as follows (1,1), (2,10), (3,3), (4,4), (5,5), (6,7), (7,2),(8,6), (9,8), (10,11), (11,15), (12,9), (13,14),(14,12), (15,16), (16,13). Calculate the rank correlation coefficient for proficiencies of This group in mathematics and statistics.</td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using spearman’s rank coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>9</td><td>Interpret the properties of correlation coefficient. A sample of 11 fathers and their elder sons gave the following data about their elder sons. Calculate the coefficient of correlation.
<table>
<tr><td>F</td><td>65</td><td>63</td><td>67</td><td>64</td><td>68</td><td>62</td><td>70</td><td>66</td><td>68</td><td>69</td><td>71</td></tr>
<tr><td>S</td><td>68</td><td>66</td><td>68</td><td>65</td><td>69</td><td>66</td><td>68</td><td>65</td><td>71</td><td>68</td><td>70</td></tr>
</table>
Where F: Father’s height in inches and S:Son’s height in inches.</td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using Pearson’s coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>10</td><td>Explain the properties of rank correlation coefficient. Following are the rank obtained by 10 students in two subjects, Statistics and Mathematics. Estimate To what extent the knowledge of the students in two subjects are related?
<table>
<tr><td>M</td><td>48</td><td>33</td><td>40</td><td>9</td><td>16</td><td>16</td><td>65</td><td>24</td><td>16</td><td>57</td></tr>
<tr><td>S</td><td>13</td><td>13</td><td>24</td><td>6</td><td>15</td><td>4</td><td>20</td><td>9</td><td>6</td><td>19</td></tr>
</table></td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using spearman’s rank coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>11</td><td>Outline the formulae of regression lines. Calculate the regression equation which best fit to the following data:
<table>
<tr><td>x</td><td>10</td><td>12</td><td>13</td><td>16</td><td>17</td><td>20</td><td>25</td></tr>
<tr><td>y</td><td>10</td><td>22</td><td>24</td><td>27</td><td>29</td><td>33</td><td>37</td></tr>
</table></td><td>Understand</td><td>Learner to recall the formulae of regression lines and Translate the inherent relation between the given two variables in to a mathematical function by using linear Regression.</td><td>CO 6</td></tr>
<tr><td>12</td><td>Outline the formulae of regression lines. In the following table S is weight of Potassium bromide which will dissolve in 100 grams. Of water at V^{o} C.</td><td>Understand</td><td>Learner to recall the formulae of regression lines and Translate the inherent relation between</td><td>CO 6</td></tr>
</table>

<table>
<tr><td></td><td>Fit an equation of the form
$S = mT + b$by the method of least squares. Use This relation to estimate S when T=50^{o}.<table><tr><td>T</td><td>0</td><td>20</td><td>40</td><td>60</td><td>80</td></tr><tr><td>S</td><td>54</td><td>65</td><td>75</td><td>85</td><td>96</td></tr></table></td><td></td><td>the given two variables in to a mathematical function by using linear Regression.</td><td></td></tr>
<tr><td>13</td><td>Interpret the properties of regression coefficients. From a sample of 200 pairs of observation the following quantities were calculated.
$\sum X=11.34, \sum Y=20.78, \sum X^2=12.16,$
$\sum Y^2=84.96, \sum XY=22.13$
From the above data show how to Calculate the coefficients of the equation $Y(x) = a + bx$.</td><td>Understand</td><td>Learner to recall the formulae of regression lines and Translate the inherent relation between the given two variables in to a mathematical function by using linear Regression.</td><td>CO 6</td></tr>
<tr><td>14</td><td>Outline the formula of angle between two regression lines. If $\sigma_x = \sigma_y = \sigma$ and the angle between the regression lines is $\mathrm{Tan}^{-1}\left(\frac{4}{3}\right)$. Calculate r.</td><td>Understand</td><td>Learner to recall the concept of regression lines and Interpret the angle between the given regression lines by using coefficient of correlation and regression coefficients.</td><td>CO 6</td></tr>
<tr><td>15</td><td>Outline the formulae of regression lines. Calculate both regression lines which best fit to the following data:<table><tr><td>x</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>14</td></tr><tr><td>y</td><td>4</td><td>2</td><td>5</td><td>10</td><td>4</td><td>11</td><td>12</td></tr></table>Also, i) find y when x= 13.ii) find x when y = 11.5</td><td>Understand</td><td>Learner to recall the formulae of regression lines and Translate the inherent relation between the given two variables in to a mathematical function by using linear Regression.</td><td>CO 6</td></tr>
<tr><td>16</td><td>Interpret the properties of regression coefficients. For 20 army personal the regression of weight of kidneys (Y) on weight of heart (X) is Y = 0.399X+6.394 and the regression of weight of heart on weight of kidneys is X=1.212Y+2.461. Calculate the correlation coefficient.</td><td>Understand</td><td>Learner to recall the concept of regression lines and Interpret the degree of closeness between the given two variables by using coefficient of correlation and regression coefficients.</td><td>CO 6</td></tr>
<tr><td>17</td><td>Outline the formulae of regression lines. Calculate the most likely production corresponding to a rainfall 40 from the following data:<table><tr><td></td><td>Rain fall (X)</td><td>Production(Y)</td></tr><tr><td>Average</td><td>30</td><td>500Kgs</td></tr><tr><td>Standard deviation</td><td>5</td><td>100Kgs</td></tr><tr><td>Coefficient of correlation</td><td>0.8</td><td>-</td></tr></table></td><td>Understand</td><td>Learner to recall the formulae of regression lines and Translate the inherent relation between the given two variables in to a mathematical function by using linear Regression.</td><td>CO 6</td></tr>
<tr><td>18</td><td>Outline the formulae of regression lines. The heights of mothers and daughters are given in the following table. From the two tables of regression estimate the expected average height of daughter when the height of the mother is 64.5 inches.<table><tr><td>M</td><td>62</td><td>63</td><td>64</td><td>64</td><td>65</td><td>66</td><td>68</td><td>70</td></tr><tr><td>D</td><td>64</td><td>65</td><td>61</td><td>69</td><td>67</td><td>68</td><td>71</td><td>65</td></tr></table>Where F: Mother’s height in inches and
D: Daughter’s height in inches.</td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using Pearson’s coefficient of correlation.</td><td>CO 6</td></tr>
</table>

<table>
<tr><td>19</td><td>Explain the properties of rank correlation coefficient. A panel of two judges P and Q graded seven dramatic performances by independently awarding marks as follows:
<table>
<tr><td>Performance</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Marks by P</td><td>46</td><td>42</td><td>44</td><td>40</td><td>43</td><td>41</td><td>45</td></tr>
<tr><td>Marks by Q</td><td>40</td><td>38</td><td>36</td><td>35</td><td>39</td><td>37</td><td>41</td></tr>
</table>
The eight performance, which judge Q would not attend, was awarded 37 marks by judge P. If judge Q had also been present, calculate how many marks would be expected to have been awarded by him to the eighth performance.</td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using spearman’s rank coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>20</td><td>Given the bi-variate data
<table>
<tr><td>X</td><td>1</td><td>5</td><td>3</td><td>2</td><td>1</td><td>1</td><td>7</td><td>3</td></tr>
<tr><td>Y</td><td>6</td><td>1</td><td>0</td><td>0</td><td>1</td><td>2</td><td>1</td><td>5</td></tr>
</table>
Using regression lines i) find y when x= 10.ii) find x when y = 2.5</td><td>Understand</td><td>Learner to recall the formulae of regression lines and Translate the inherent relation between the given two variables in to a mathematical function by using linear Regression.</td><td>CO 6</td></tr>
<tr><td colspan="5">PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)</td></tr>
<tr><td>1</td><td>Interpret the properties of correlation coefficient. Calculate coefficient of correlation between X and Y for the following data.
<table>
<tr><td>X</td><td>10</td><td>12</td><td>18</td><td>24</td><td>23</td><td>27</td></tr>
<tr><td>Y</td><td>13</td><td>18</td><td>12</td><td>25</td><td>30</td><td>10</td></tr>
</table></td><td>Understand</td><td>Learner to recall the concept of coefficient of correlation and Interpret the degree of closeness between the given two variables by using Pearson’s coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>2</td><td>Interpret the properties of rank correlation coefficient. Ten competitors in a musical test were ranked by the three judges A, B and C in the following order.
<table>
<tr><td>Rank A</td><td>1</td><td>6</td><td>5</td><td>10</td><td>3</td><td>2</td><td>4</td><td>9</td><td>7</td><td>8</td></tr>
<tr><td>Rank B</td><td>3</td><td>5</td><td>8</td><td>4</td><td>7</td><td>10</td><td>2</td><td>1</td><td>6</td><td>9</td></tr>
<tr><td>Rank C</td><td>6</td><td>4</td><td>9</td><td>8</td><td>1</td><td>2</td><td>3</td><td>10</td><td>5</td><td>7</td></tr>
</table>
Using rank correlation method, estimate which pair of judges has the nearest approach to common likings in music.</td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using spearman’s rank coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>3</td><td>Interpret the properties of rank correlation coefficient. Obtain the rank correlation coefficient for the following data.
<table>
<tr><td>X</td><td>68</td><td>64</td><td>75</td><td>50</td><td>64</td><td>80</td><td>75</td><td>40</td><td>55</td><td>64</td></tr>
<tr><td>Y</td><td>62</td><td>58</td><td>68</td><td>45</td><td>81</td><td>60</td><td>68</td><td>48</td><td>50</td><td>70</td></tr>
</table></td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using spearman’s rank coefficient of correlation.</td><td>CO 6</td></tr>
<tr><td>4</td><td>Show that the coefficient of correlation lies between -1 and 1.</td><td>Understand</td><td>Learner to recall the concept of coefficient of correlation and outline the proof if the theorem that coefficient of correlation lies between -1 and 1.</td><td>CO 6</td></tr>
<tr><td>5</td><td>Interpret the properties of rank correlation coefficient. The ranks of the 15 students in two subjects A and B are given below, the two numbers within the brackets denoting the ranks of the same student in A and B respectively.</td><td>Understand</td><td>Learner to recall the concept of coefficient of rank correlation and Interpret the degree of closeness between the given two variables by using spearman’s</td><td>CO 6</td></tr>
</table>

<table>
<tr><td></td><td>(1,10), (2,7), (3,2), (4,6), (5,4), (6,8), (7,3), (8,1), (9,11), (10,15), (11,9), (12,5), (13,14), (14,12), (15,13)
Use Spearman’s formula to Calculate the rank correlation coefficient.</td><td></td><td>rank coefficient of correlation.</td><td></td></tr>
<tr><td>6</td><td>Outline the proof of the formula of angle between two regression lines.</td><td>Understand</td><td>Learner to recall the concept of regression lines and Interpret the angle between the given regression lines by using coefficient of correlation and regression coefficients.</td><td>CO 6</td></tr>
<tr><td>7</td><td>Outline the formula of angle between two regression lines. If $\sigma_x = \sigma_y = \sigma$ and the angle between the regression lines are $\theta = Tan^{-1}(3)$ .Obtain r.</td><td>Understand</td><td>Learner to recall the concept of regression lines and Interpret the angle between the given regression lines by using coefficient of correlation and regression coefficients.</td><td>CO 6</td></tr>
<tr><td>8</td><td>Outline the formula of angle between two regression lines. If θ is the angle between two regression lines and S.D. of Y is twice the S.D. of X and r = 0.25, Calculate tan θ.</td><td>Understand</td><td>Learner to recall the concept of regression lines and Interpret the angle between the given regression lines by using coefficient of correlation and regression coefficients.</td><td>CO 6</td></tr>
<tr><td>9</td><td>Outline the formulae of regression lines. Calculate the value of y when x =12 from the following data:
<table>
<tr><td></td><td>X</td><td>Y</td></tr>
<tr><td>Average</td><td>7.6</td><td>14.8</td></tr>
<tr><td>Standard deviation</td><td>3.6</td><td>2.5</td></tr>
<tr><td>Coefficient of correlation</td><td>0.99</td><td>-</td></tr>
</table></td><td>Understand</td><td>Learner to recall the formulae of regression lines and Translate the inherent relation between the given two variables in to a mathematical function by using linear Regression.</td><td>CO 6</td></tr>
<tr><td>10</td><td>Outline the formulae of regression lines. Construct the regression equation of Y on X from the data given below, taking deviations from actual means of X and Y.
<table>
<tr><td>Price (Rs.)</td><td>10</td><td>12</td><td>13</td><td>12</td><td>16</td><td>15</td></tr>
<tr><td>Amount demanded</td><td>40</td><td>38</td><td>43</td><td>45</td><td>37</td><td>43</td></tr>
</table>
Estimate the likely demand when the price is Rs. 20.</td><td>Understand</td><td>Learner to recall the formulae of regression lines and Translate the inherent relation between the given two variables in to a mathematical function by using linear Regression.</td><td>CO 6</td></tr>
<tr><td colspan="5">MODULE - IV</td></tr>
<tr><td colspan="5">TESTING OF HYPOTHESIS</td></tr>
<tr><td colspan="5">PART - A (SHORT ANSWER QUESTIONS)</td></tr>
<tr><td>1</td><td>List out the different types of sampling methods.</td><td>Remember</td><td>---</td><td>CO 7</td></tr>
<tr><td>2</td><td>State the definition of population? Give an example.</td><td>Remember</td><td>---</td><td>CO 7</td></tr>
<tr><td>3</td><td>State the definition of sample? Give an example.</td><td>Remember</td><td>---</td><td>CO 7</td></tr>
<tr><td>4</td><td>State the definition of parameter and statistic.</td><td>Remember</td><td>---</td><td>CO 7</td></tr>
<tr><td>5</td><td>Find the value of correction factor if n=5 and N=200.</td><td>Remember</td><td>---</td><td>CO 7</td></tr>
</table>

6	State the definition of standard error of a statistic.	Remember	---	CO 7
7	Find out How many different samples of size n=2 can be chosen from a finite population of size 25.	Remember	---	CO 7
8	Find the standard error and probable error of sample size 14 and correlation coefficient 0.74.	Remember	---	CO 7
9	If the population consists of four members 1, 5, 6, 8, Find How many samples of size three can be drawn with replacement?	Remember	---	CO 7
10	The mean weekly wages of workers are with standard deviation of rupees 4. A sample of 625 is selected. Find the standard error of the mean.	Remember	---	CO 7
11	List out the differences between large and small samples with example.	Remember	---	CO 7
12	In a manufacturing company out of 100 goods 25 are top quality. Find sample proportion.	Remember	---	CO 7
13	Find the confidence interval for single mean if mean of sample size of 400 is 40, standard deviation is 10.	Remember	---	CO 7
14	Find the confidence interval for single proportion if 18 goods are defective from a sample of 200 goods.	Remember	---	CO 7
15	State the Formula of standard error of sample proportion.	Remember	---	CO 7
16	In a manufacturing company out of 200 goods 80 were faulty. Find the sample proportion.	Remember	---	CO 7
17	Find the sample proportion in one day production of 400 articles only 50 are top quality.	Remember	---	CO 7
18	State the formula for difference of means in large samples.	Remember	---	CO 7
19	State the formula of test statistic for difference of proportions in large samples.	Remember	---	CO 7
20	Find the confidence interval for mean if mean of sample size of 144 is 150, standard deviation is 2.	Remember	---	CO 7
PART-B (LONG ANSWER QUESTIONS)				
1	A population consists of ranks of five students based on their performance in a physical test namely 2,3,6,8 and 11. Consider all possible samples of size two which can be drawn with replacement from This population. Calculate The mean of the population. The standard deviation of the population. The mean of the sampling distribution of means. The standard deviation of the sampling distribution of means.	Apply	Learner to recall the concept of sampling distribution of means and explain the parameters related to sampling distribution of means under with replacement and hence use them to calculate the required values.	CO 7
2	A population consists of ranks of six students based on their performance in a physical test namely 5, 10, 14, 18, 13, 24. Consider all possible samples of size two which can be drawn without replacement from This population. Calculate The mean of the population. The standard deviation of the population. The mean of the sampling distribution of means.	Apply	Learner to recall the concept of sampling distribution of means and explain the parameters related to sampling distribution of means under without replacement and hence use them to calculate the required values.	CO 7

	The standard deviation of the sampling distribution of means.			
3	A population consists of ranks of six students based on their performance in a physical test namely 4, 8, 12, 16, 20, 24. Consider all possible samples of size two which can be drawn without replacement from This population. Calculate The mean of the population. The standard deviation of the population. The mean of the sampling distribution of means. he standard deviation of the sampling distribution of means.	Apply	Learner to recall the concept of sampling distribution of means and explain the parameters related to sampling distribution of means under without replacement and hence use them to calculate the required values.	CO 7
4	A population consists of ranks of six students based on their performance in a physical test. Samples of size 2 are taken from the population 1, 2, 3, 4, 5, 6. Which can be drawn with replacement? Calculate The mean of the population. The standard deviation of the population. The mean of the sampling distribution of means. The standard deviation of the sampling distribution of means.	Apply	Learner to recall the concept of sampling distribution of means and explain the parameters related to sampling distribution of means under with replacement and hence use them to calculate the required values.	CO 7
5	A population consists of ranks of five students based on their performance in a physical test. Samples of size 2 are taken from the population 3, 6, 9, 15 27. Which can be drawn with replacement? Calculate i) The mean of the population ii) The standard deviation of the population iii) The mean of the sampling distribution of means iv) The standard deviation of the sampling distribution of means.	Apply	Learner to recall the concept of sampling distribution of means and explain the parameters related to sampling distribution of means under with replacement and hence use them to calculate the required values.	CO 7
6	A population consists of ranks of five students based on their performance in a physical test. If the population is 3, 6, 9, 15, 27. List all possible samples of size 3 that can be taken without replacement from the finite population. Calculate the mean of each of the sampling distribution of means. Calculate the standard deviation of sampling distribution of means.	Apply	Learner to recall the concept of sampling distribution of means and explain the parameters related to sampling distribution of means under without replacement and hence use them to calculate the required values.	CO 7
7	The mean height of students in a college is 155 cm and standard deviation is 15. Estimate the probability that the mean height of 36 students is less than 157 cm.	Apply	Learner to recall the statement of central limit theorem and Relate it to the normality and calculate the required probabilities by using the concept of central limit theorem.	CO 5
8	A random sample of size 100 is taken from an infinite population having the mean 76 and the variance 256. Estimate the probability that $\bar{x}$ will be between 75 and 78.	Apply	Learner to recall the statement of central limit theorem and Relate it to the normality and calculate the required probabilities by using the concept of central limit theorem	CO 5

9	The mean of certain normal population is equal to the standard error of the mean of the samples of 64 from that distribution. Calculate the probability that the mean of the sample size 36 will be negative.	Apply	Learner to recall the statement of central limit theorem and Relate it to the normality and calculate the required probabilities by using the concept of central limit theorem	CO 5
10	A random sample of size 64 is taken from a normal population with μ = 51.4 and σ = 68. Estimate the probability that the mean of the sample will i) exceed 52.9 ii) fall between 50.5 and 52.3 iii) be less than 50.6.	Apply	Learner to recall the statement of central limit theorem and Relate it to the normality and calculate the required probabilities by using the concept of central limit theorem	CO 5
11	A sample of 400 items is taken from a population whose standard deviation is 10. The mean of sample is 40. Examine whether the sample has come from a population with mean 38 also calculate 95% confidence interval for the population.	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.	CO 8,11
12	The means of two large samples of sizes 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of S.D 2.5 inches?	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.	CO 8, CO 11
13	An ambulance service claims that it takes on the average 8.9 minutes to reach its destination in emergency calls. To check on This claim the agency which issues license to Ambulance service has then timed on fifty emergency calls getting a mean of 9.2 minutes with 1.6 minutes. Examine the claim at 5% LOS	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.	CO 8, CO 11
14	According to norms established for a mechanical aptitude test, the persons who are 18 years have an average weight of 73.2 with S.D 8.6 if 40 randomly selected persons have average 76.7 Examine the truth value of the hypothesis $H_0 : \mu$ =73.2 against alternative hypothesis: μ >73.2.	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.	CO 8, CO 11
15	A sample of 100 electric bulbs produced by manufacturer ‘A’ showed a mean life time of 1190 hours and s .d. of 90 hours A sample of 75 bulbs produced by manufacturer ‘B’ Showed a mean life time of 1230 hours with s.d. of 120 hrs. Examine whether there is any difference between the mean life times of the two brands at a significance level of 0.05.	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.	CO 8, CO 11
16	On the basis of their total scores, 200 candidates of a civil service examination are divided into two groups; the first group is 30% and the remaining 70%. Consider the first question of the examination among	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the	CO 8

<table>
<tr><td></td><td>the first group, 40 had the correct answer. Whereas among the second group, 80 had the correct answer. On the basis of these results, can one conclude that the first question is not good at discriminating ability of the type being examined here.</td><td></td><td>calculated test statistic value with the tabulated value to draw the inference.</td><td></td></tr>
<tr><td>17</td><td>A cigarette manufacturing firm claims that brand A line of cigarettes outsells its brand B by 8%. if it is found that 42 out of a sample of 200 smokers prefer brand A and 18 out of another sample of 100 smokers prefer brand B. Examine whether 8% difference is a valid claim.</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>18</td><td>If 48 out of 400 persons in rural area possessed ‘cell’ phones while 120 out of 500 in urban area. Can it be accepted that the proportion of ‘cell’ phones in the rural area and Urban area is same or not. Use 5% of level of significance.</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>19</td><td>Samples of students were drawn from two universities and from their weights in kilograms mean and S.D are calculated and shown below make a large sample Examine the significance of difference between means.
<table>
<tr><td></td><td>Mean</td><td>Standard Deviation</td><td>Sample Size</td></tr>
<tr><td>University A</td><td>55</td><td>10</td><td>400</td></tr>
<tr><td>University B</td><td>57</td><td>15</td><td>100</td></tr>
</table></td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>20</td><td>In a big city 325 men out of 600 men were found to be smokers. Does This information support the conclusion that the majority of men in This city are smokers?</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td colspan="5">PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)</td></tr>
<tr><td>1</td><td>Let S= {1, 5, 6, 8}, Calculate the probability distribution of the sample mean for random sample of size 2 drawn without replacement. Calculate
i) The mean of the population.
ii) The standard deviation of the population.
iii) The mean of the sampling distribution of means.
iv) The standard deviation of the sampling distribution of means.</td><td>Apply</td><td>Learner to recall the concept of sampling distribution of means and explain the parameters related to sampling distribution of means under without replacement and hence use them to calculate the required values.</td><td>CO 7</td></tr>
<tr><td>2</td><td>Samples of size 2 are taken from the population 1, 2, 3, 4, 5, 6. Which can be drawn without replacement? Calculate
i) The mean of the population.
ii) The standard deviation of the population.
iii) The mean of the sampling distribution of means.</td><td>Apply</td><td>Learner to recall the concept of sampling distribution of means and explain the parameters related to sampling distribution of means under without replacement and hence use them to calculate the required values.</td><td>CO 7</td></tr>
</table>

	iv) The standard deviation of the sampling distribution of means.			
3	A normal population has a mean of 0.1 and standard deviation of 2.1. Calculate the probability that mean of a sample of size 900 will be negative.	Apply	Learner to recall the statement of central limit theorem and Relate it to the normality and calculate the required probabilities by using the concept of central limit theorem	CO 5
4	A random sample of size 64 is taken from an infinite population having the mean 45 and the standard deviation 8. Calculate probability that x will be between 46 and 47.5.	Apply	Learner to recall the statement of central limit theorem and Relate it to the normality and calculate the required probabilities by using the concept of central limit theorem	CO 5
5	If a 1-gallon can of paint covers on an average 513 square feet with a standard deviation of 31.5 square feet, Calculate the probability that the mean area covered by a sample of 40 of these 1-gallon cans will be anywhere from 510 to 520 square feet?	Apply	Learner to recall the statement of central limit theorem and Relate it to the normality and calculate the required probabilities by using the concept of central limit theorem	CO 5
6	A sample of 900 members has mean of 3.4 and S.D of 2.61.is This sample has been taken from a large population mean 3.25 and S.D 2. 61? Also calculate 95% confidence interval.	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.	CO 8, CO 11
7	It is claimed that a random sample of 49 tires has a mean life of 15200 kms This sample was taken from population whose mean is 15150 kms and S.D is 1200 km Examine the truth value of the claim at 0.05 level of significant.	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.	CO 8, CO 11
8	A manufacturer claims that at least 95% of the equipment which he supplied to a factory conformed to specifications. An examination of sample of 200 pieces of equipment received 18 were faulty Examine the truth value of the claim at 0.05 level.	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.	CO 8, CO 11
9	Among the items produced by a factory out of 500, 15 were defective. In another sample of 400, 20 were defective Examine whether there is any significant difference between two proportions at 5% level.	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.	CO 8
10	A manufacturer produced 20 defective articles in a batch of 400. After overhauled it produced 10 defectives in a batch of 300 Examine whether the machine being improved after over hauling or not.	Apply	Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the	CO 8

			calculated test statistic value with the tabulated value to draw the inference.	
MODULE - V				
TESTS OF SIGNIFICANCE				
PART - A (SHORT ANSWER QUESTIONS)				
1	If $\bar{x}$ =47.5, $\mu = 42.1, s = 8.4, n = 24$ then Find t.	Remember	---	CO 8
2	List the differences between t-test and F-test.	Remember	---	CO 8
3	If $\bar{x}$ =40, $\mu = 25, s = 8.4, n = 24$ then Find t.	Remember	---	CO 8
4	State the definition of the statistic for t test for single mean?	Remember	---	CO 8
5	State the definition of degree of freedom.	Remember	---	CO 8
6	State the Formula of the degree of freedom for F test?	Remember	---	CO 8
7	Find $F_{0.05}$ with (7, 8) degrees of freedom.	Remember	---	CO 8
8	Find $t_{0.05}$ when 16 degrees of freedom.	Remember	---	CO 8
9	A random sample of size 16 from a normal population. The mean of sample is 53 and sum of square of deviations from mean is 150.can This sample is regarded as taken from the population having mean 56 at 0.05 level of significance.	Remember	---	CO 8
10	Find $F_{0.95}$ with (19, 24) degrees of freedom.	Remember	---	CO 8
11	State the definition of the statistic for t test for difference of means?	Remember	---	CO 8
12	Find $t_{0.99}$ when 7 degrees of freedom.	Remember	---	CO 8
13	State the formula of the degree of freedom for t test for difference of means?	Remember	---	CO 8
14	Find $t_{0.95}$ when 9 degrees of freedom.	Remember	---	CO 8
15	State the definition of the statistic for F test?	Remember	---	CO 8
16	Find $F_{0.99}$ with (28, 12) degrees of freedom.	Remember	---	CO 8
17	State the formulae for sample variance and sample standard deviation.	Remember	---	CO 8
18	State the formula of the degree of freedom for chi square test for contingency table of order 4x3?	Remember	---	CO 8
19	State the Formula of statistic for chi square test?	Remember	---	CO 8
20	Find $\chi^2_{0.05}$ at 9 degrees of freedom.	Remember	---	CO 8

<table>
<tr><th colspan="5">PART-B (LONG ANSWER QUESTIONS)</th></tr>
<tr><td>1</td><td>Producer of ‘gutkha’ claims that the nicotine content in his ‘gutkha’ on the average is 0.83 mg. can This claim be accepted if a random sample of 8 ‘gutkhas’ of This type have the nicotine contents of 2.0,1.7,2.1, 1.9,2.2, 2.1, 2.0,1.6 mg.</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8,CO 11</td></tr>
<tr><td>2</td><td>A sample of 26 bulbs gives a mean life of 990 hours with S.D of 20hrs. The manufacturer claims that the mean life of bulbs 1000 hrs. Examine whether the sample is up to the standard or not?</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>3</td><td>A random sample of 10 boys had the following I. Q’s 70,120,110,101,88,83,95,98,107,100. Do the data support the assumption of population means I.Q of 100. Examine the truth value of the claim at 5% level of significance?</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>4</td><td>The means of two random samples of sizes 9,7 are 196.42 and 198.82.the sum of squares of deviations from their respective means are 26.94, 18.73.can the samples be considered to have been the same population?</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>5</td><td>In one sample of 8 observations the sum of squares of deviations of the sample values from the sample mean was 84.4 and another sample of 10 observations it was 102.6. Examine whether there is any significant difference between two sample variances at at 5% level of significance.</td><td>Apply</td><td>Learner to recall the procedure of F-test for equality of variances and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>6</td><td>Two random samples gave the following results.
<table>
<tr><th>Sample</th><th>size</th><th>Sample mean</th><th>Sum of squares of deviations from mean</th></tr>
<tr><td>I</td><td>10</td><td>15</td><td>90</td></tr>
<tr><td>II</td><td>12</td><td>14</td><td>108</td></tr>
</table>
Examine whether the samples came from the same population or not?</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>7</td><td>Two independent samples of items are given respectively had the following values.
<table>
<tr><td>Sample I</td><td>11</td><td>11</td><td>13</td><td>11</td><td>15</td><td>9</td><td>12</td><td>14</td></tr>
<tr><td>Sample II</td><td>9</td><td>11</td><td>10</td><td>13</td><td>9</td><td>8</td><td>10</td><td>-</td></tr>
</table>
Examine whether there is any significant difference between their means?</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
</table>

<table>
<tr><td>8</td><td>Time taken by workers in performing a job by method 1 and method 2 is given below.
<table><tr><td>Method 1</td><td>20</td><td>16</td><td>27</td><td>23</td><td>22</td><td>26</td><td>-</td></tr><tr><td>Method 2</td><td>27</td><td>33</td><td>42</td><td>35</td><td>32</td><td>34</td><td>38</td></tr></table>
Does the data show that variances of time distribution from population which these samples are drawn do not differ significantly?</td><td>Apply</td><td>Learner to recall the procedure of F-test for equality of variances and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>9</td><td>The no. of automobile accidents per week in a certain area as follows: 12,8,20,2,14,10,15,6,9,4. Are these frequencies in agreement with the belief that accidents were same in the during last 10 weeks.</td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for equal frequencies and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>10</td><td>A die is thrown 264 times with the following results. Prove that the die is unbiased.
<table><tr><td>No appeared-on die</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>Frequency</td><td>40</td><td>32</td><td>28</td><td>58</td><td>54</td><td>52</td></tr></table></td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for unbiasedness and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>11</td><td>200 digits were chosen at random from set of tables the frequency of the digits is
<table><tr><td>d</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr><tr><td>f</td><td>18</td><td>19</td><td>23</td><td>21</td><td>16</td><td>25</td><td>22</td><td>20</td><td>21</td><td>15</td></tr></table>Where d: digits and f: frequencies.Use chi square test to examine the correctness of the hypothesis that the digits are distributed in equal number in the table.</td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for equal frequencies and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>12</td><td>Estimate the expected frequencies by using Poisson distribution to the following data and Examine goodness of fit at 0.05 level.
<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>f</td><td>305</td><td>366</td><td>210</td><td>80</td><td>28</td><td>9</td><td>2</td><td>1</td></tr></table></td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for goodness of fit and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>13</td><td>Given below is the number of male births in 1000 families having 5 children
<table><tr><td>Male children</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Number of families</td><td>40</td><td>300</td><td>250</td><td>200</td><td>30</td><td>180</td></tr></table>
Examine whether the given data is consistent with the hypothesis that the binomial distribution holds if the chance of a male birth is equal to female birth.</td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for goodness of fit and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>14</td><td>5 dice were thrown 96 times the number of times
<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>frequency</td><td>1</td><td>10</td><td>24</td><td>35</td><td>18</td><td>8</td></tr></table>showing 4,5 or 6 obtain is given below
Fit a binomial distribution and Examine the goodness of fit.</td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for goodness of fit and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
</table>

<table>
<tr><td>15</td><td>A survey of 240 families with 4 children each revealed the following distribution.<table><tr><td>Male Births</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>No of families</td><td>10</td><td>55</td><td>105</td><td>58</td><td>12</td></tr></table>Examine whether the male and female births are equally popular by selecting suitable probability distribution for computing expected frequencies.</td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for goodness of fit and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 9</td></tr>
<tr><td>16</td><td>The average breaking strength of the steel rods is specified to be 18.5 thousand pounds. sample of 14 rods were tested. The mean and S.D obtained were 17.85 and 1.955 respectively. Is the result of experiment significant?</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>17</td><td>A group of 5 patients treated with medicine A weigh 42, 39, 48, 60 and 41 kgs. Second group of 7 patients from the same hospital treated with medicine B weigh 38, 42, 56, 64, 68, 69 and 62 kgs. Do you agree with the claim that medicine B increases the weigh significantly?</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>18</td><td>In one sample of 10 observations, the sum of the deviations of the sample values from sample mean was 120 and in the other sample of 12 observations it was 314. Examine whether the difference is significant at 5% level.</td><td>Apply</td><td>Learner to recall the procedure of F-test for equality of variances and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>19</td><td>The following table gives the classification of 100 workers according to gender and nature of work. Examine whether the nature of work is independent of the gender of the worker.<table><tr><td></td><td>Stable</td><td>Unstable</td><td>Total</td></tr><tr><td>Male</td><td>40</td><td>20</td><td>60</td></tr><tr><td>Female</td><td>10</td><td>30</td><td>40</td></tr><tr><td>Total</td><td>50</td><td>50</td><td>100</td></tr></table></td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for independency of attributes and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>20</td><td>The following random samples are measurements of the heat-producing capacity (in millions of calories per ton) of specimens of coal from two mines:<table><tr><td>Mine 1</td><td>8,260</td><td>8,130</td><td>8,350</td><td>8,070</td><td>8,340</td><td>…</td></tr><tr><td>Mine 2</td><td>7,950</td><td>1,890</td><td>7,900</td><td>8,140</td><td>7,920</td><td>7,840</td></tr></table>Use the 0.05 level of significance to Examine whether it is reasonable to assume that the variances of the two populations are equal.</td><td>Apply</td><td>Learner to recall the procedure of F-test for equality of variances and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td colspan="5">PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)</td></tr>
<tr><td>1</td><td>A mechanist making engine parts with axle diameters of 0.700 inch. A random sample of 10 parts shows a mean diameter of 0.742 inch with a S.D of 0.040 inch. Compute the statistic you would use to Examine whether the work is meeting the specifications.</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
</table>

<table>
<tr><td>2</td><td>To examine the hypothesis that the husbands are more intelligent than the wives, an investigator took a sample of 9 couples and administered them a test measures the I.Q. The results are as follows.
<table>
<tr><td>H</td><td>117</td><td>105</td><td>97</td><td>105</td><td>123</td><td>109</td><td>86</td><td>78</td><td>103</td></tr>
<tr><td>W</td><td>106</td><td>98</td><td>87</td><td>104</td><td>116</td><td>95</td><td>90</td><td>69</td><td>108</td></tr>
</table>
Where H: husband’s I.Q., W: wife’s I.Q.Examine the truth value of the hypothesis at level of significance of 0.05.</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>3</td><td>Two independent samples of 8 & 7 items respectively had the following values.
<table>
<tr><td>Sample I</td><td>11</td><td>11</td><td>13</td><td>11</td><td>15</td><td>9</td><td>12</td></tr>
<tr><td>Sample II</td><td>9</td><td>11</td><td>10</td><td>13</td><td>9</td><td>8</td><td>10</td></tr>
</table>
Is the difference between the means of samples significant?</td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>4</td><td>Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins. the sample standard deviation of their weights as 0.8 and 0.5 respectively. Assuming that the weight distributions are normal, Examine the truth value of hypothesis that the true variances are equal.</td><td>Apply</td><td>Learner to recall the procedure of F-test for equality of variances and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>5</td><td>From the following data, calculate whether there is any significant liking in the habit of taking soft drinks among the categories of employees.
<table>
<tr><td>Soft drinks</td><td>Clerks</td><td>Teachers</td><td>officers</td></tr>
<tr><td>Pepsi</td><td>10</td><td>25</td><td>65</td></tr>
<tr><td>Thumbs up</td><td>15</td><td>30</td><td>65</td></tr>
<tr><td>Fanta</td><td>50</td><td>60</td><td>30</td></tr>
</table></td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for independency of attributes and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>6</td><td>In an investigation on the machine performance, the following results are obtained.
<table>
<tr><td></td><td>No of units inspected</td><td>Noof defective</td></tr>
<tr><td>Machine1</td><td>375</td><td>17</td></tr>
<tr><td>Machine2</td><td>450</td><td>22</td></tr>
</table>
Examine whether the performance of the machines is independent or not by using chi square test at 5% LOS.</td><td>Apply</td><td>Learner to recall the procedure of Chi square-test for independency of attributes and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>7</td><td>The following is the distribution of the number of trucks arriving at a company ware house for every two hours.
<table>
<tr><td>Time Intervals</td><td>0</td><td>2</td><td>4</td><td>6</td></tr>
<tr><td>Frequency of no of trucks</td><td>52</td><td>130</td><td>45</td><td>3</td></tr>
</table>
Fit Poisson distribution as well as binomial distribution to the above table and Test for the assessment of goodness of fit of both distributions at 0.05 level and conclude which distribution frequencies are nearer to the original data.</td><td>Analyze</td><td>Learner to recall the procedure of Chi square-test for goodness of fit and fit binomial as well as Poisson distributions, calculate test statistic value through chi-square test compare it with the tabulated value to draw the inference, test for the assessment of goodness of fit for both distributions and select the best fit distribution basing on the results.</td><td>CO 9</td></tr>
</table>

<table>
<tr><td>8</td><td>Samples of students were drawn from two universities and from their weights in kilograms mean and S.D are calculated and shown below make a large sample Examine the significance of difference between means.
<table><tr><th></th><th>Mean</th><th>Standard Deviation</th><th>Sample Size</th></tr><tr><td>University A</td><td>55</td><td>10</td><td>10</td></tr><tr><td>University B</td><td>57</td><td>15</td><td>20</td></tr></table></td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
<tr><td>9</td><td>The measurements of the output of two units have given the following results. Assuming that both samples have been obtained from the normal populations at 10% significant level, examine whether the two populations have the same variance.
<table><tr><td>Unit- A</td><td>14.1</td><td>10.1</td><td>14.7</td><td>13.7</td><td>14.0</td></tr><tr><td>Unit - B</td><td>14.0</td><td>14.5</td><td>13.7</td><td>12.7</td><td>14.1</td></tr></table></td><td>Apply</td><td>Learner to recall the procedure of F-test for equality of variances and calculate test statistic value compare it with the tabulated value to draw the inference.</td><td>CO 8</td></tr>
<tr><td>10</td><td>The nicotine in milligrams of two samples of tobacco were found to be as follows. Examine the truth value of the hypothesis for the difference between means at 0.05 level.
<table><tr><td>Sample-A</td><td>24</td><td>27</td><td>26</td><td>23</td><td>25</td><td>-</td></tr><tr><td>Sample-B</td><td>29</td><td>30</td><td>30</td><td>31</td><td>24</td><td>36</td></tr></table></td><td>Apply</td><td>Learner to recall the procedure of testing of hypothesis and select the suitable test statistic formula and compare the calculated test statistic value with the tabulated value to draw the inference.</td><td>CO 8, CO 11</td></tr>
</table>

Prepared by:

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