INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

PROBABILITY AND STATISTICS
QUESTION BANK

1	Department	**COMPUTER SCIENCE AND ENGINEERING**					
2	Course Title	**PROBABILITY AND STATISTICS**					
3	Course Code	AHSD11					
4	Program	B.Tech					
5	Semester	III					
6	Regulation	BT-23					
7	Structure of the course	Theory			Practical		
		Lecture	Tutorials	Credits	Lab	Credits	
		3	1	4	-	-	
8	Type of course (**Tick type of course**)	Core ✓	Professional Elective ×	Open Elective ×	VAC ×	MOOCs ×	
9	Course Offered	Odd Semester ✓		Even Semester ×			
10	**Total lecture, tutorial and practical hours for this course (16 weeks of teaching per semester)**						
	Lectures: 48 hours		Tutorials: 16 hours		Practical: 0 hours		
11	Course Instructor	Dr. G SRINIVASU					
12	Date Approved by BOS	23/08/2023					
13	Course Webpage	www.iare.ac.in/—-/—-					
14	Course Prerequistes	**Level**	**Course Code**	**Semester**	**Prerequisites**		
		B.Tech	AHSD02 AHSD08	I/ II	Matrices and Calculus / DEVC		

15. COURSE OBJECTIVES:

The students will try to learn:

I	The theory of probability, conditional probability, Bayes theorem and their applications.
II	The theory of random variables, basic random variate distributions and their applications.
III	The role of Binomial, Poisson and Normal distributions in solving the real-life problems.
IV	The methods and techniques for quantifying the degree of closeness among two or more variables by using coefficient of correlation and the concept of linear regression analysis.

V	The Estimation theory and hypothesis testing in statistics play a vital role in the assessment of the quality of the materials, products and ensuring the standards of the engineering process.

16. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Define** the axioms of the probability, conditional probability and by using these concepts, establish the elementary theorems on probability. Explain the role of Bayes theorem in solving the typical uncertain problems in probability.	Understand
CO 2	**Explain** the role of random variables and types of random variables, expected values of the discrete and continuous random variables under randomized probabilistic conditions.	Understand
CO 3	**Interpret** the parameters of descrete random variate Probability distributions such as Binomial, Poisson distributions by using their probability functions, expectation and variance.	Understand
CO 4	**Apply** the Normal distribution for the problems defined under continuous random variables to find probabilities.	Apply
CO 5	**Identify** Bivariate Regression as well as Correlation Analysi for statistical forecasting	Apply
CO 6	**Identify** the role of statistical hypotheses, confidence intervals, the tests of hypotheses for large samples and small samples in making decisions over statistical claims in hypothesis testing	Apply

QUESTION BANK:

Q.No	QUESTION	Taxonomy	How does this subsume the level	CO's
		MODULE I		
		PROBABILITY THEORY		
		PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS		
1	A committee consists of 9 students 2 of which are from 1st year, 3 from second year and 4 from third year. Three students are to be removed at random. What is the chance that (i) The three students belong to different classes. (ii) Two belong to the same class and third to the different class. (iii) The three belong to the same class.	Apply	Learner to recall the concept of a theory of probability and use it to calculate the required solutions.	CO 1
2	Two dice are thrown,let A be the event of getting sum of points is odd.B is the event at least one ace.Describe the A and B and A∩ B.Find P(A),P(B),P(A/B),P(B/A).	Apply	Learner to recall the concept of a theory of probability and use it to calculate the required solutions.	CO 1
3	State and prove Law of addition of probability for two events	Apply	Learner to recall the concept of axioms of probability and use it to prove the theorem.	CO 1
4	Define conditional probability and state and prove the multiplication theorem on probability	Remember	Learner to recall the concept of conditional probability and use it to prove the theorem.	CO 1
5	If A and B are two independent events then show that (i) $\bar{A}$ and B (ii) A and $\bar{B}$ (iii) $\bar{A}$ and $\bar{B}$ are also independent.	Understand	Learner to recall the concept of independent events and use it to prove the theorem.	CO 1
6	A bag contains 5 red,3 black balls.Second bag contains 4 red,5 black balls.One of the bags is selected at random and 2 balls are drawn from it.What is the probability that one ball is red and second ball is black.	Apply	Learner to recall the concept of theory of probability and use it to prove the theorem.	CO 1

7	If two dice are thrown, what is the probability that the sum is (i) greater than 8 and (ii) neither 7 nor 11.	Apply	Learner to recall the concept of theory of probability and addition theorem to find the solution.	CO 1
8	In a group there are 4 men and 2 women form this group ,three persons are selected at random .Find the probability that three persons are a) 1 men and 2 women b) 2 men and 1 women.	Apply	Learner to recall the concept of theory of probability to find the solution.	CO 1
9	A problem in statistics is given to the three students A, B and C whose chances of solving it or $\frac{1}{2}, \frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved if all of them try independently.	Apply	Learner to recall the concept of theory of probability to find the solution.	CO 1
10	Three boxes contains: 3 red, 4 white and 1 blue; 1 red, 2 white and 3 blue balls; 4 red, 3 white, and 2 blue balls. One box is chosen at random and a ball is withdrawn it happens to be red. What is the probability that it come from box two.	Apply	Learner to recall the concept of Bayes theorem to find the solution.	CO 1
PART-B LONG ANSWER QUESTIONS				
1	60 boys and 20 girls are there in a class . Half of the boys and half of the girls of the class play cricket.Find the probability of the selected person to be a boy or a girl,who plays cricket.	Apply	Learner to recall the concept of theorem of probability to find the solution.	CO 1
2	A bag contains 5 red and 10 black balls. 8 of them are placed in another box. What is the chance that the later box contains 2 red and 6 black balls.	Apply	Learner to recall the concept of theorem of probability to find the solution.	CO 1

3	Box I has 2 block balls,3 red balls and 1 white ball.Box II has 1 block ball,1 red ball and 2 white balls.Box III has 5 black balls,3 red balls and 4 white balls.One box is selected at random ; one ball is drawn.Find the probability that the ball is red .	Apply	Learner to recall the concept of theorem of probability to find the solution.	CO 1
4	A bag contains 10 gold and 8 silver coins. Two successive drawings of 4 coins are made such that (i) coins are replaced before the second trial. (ii) the coins are not replaced before the second trial. Find the probability that the first drawing will give 4 gold and the 4 silver coins.	Apply	Learner to recall the concept of theorem of probability to find the solution.	CO 1
5	If A and B are any two events then prove that P$(A^c \cap B) =$ P(B) - P(A $\cap$ B).	Apply	Learner to recall the axioms of probability to find the solution.	CO 1
6	A box contains 6 red, 4 white and 5 black balls. A person draws 4 balls at random from the box. Find the probability that among the balls drawn there is at least 1 ball of each colour.	Apply	Learner to recall the concepts of theorem of probability to find the solution.	CO 1
7	If A and B are any two events then prove that P$(A \cap B^c) =$ P(A) - P(A $\cap$ B).	Apply	Learner to recall the concepts of theorem of probability to find the solution.	CO 1
8	A card is drawn from a well shuffled pack of cards. What is the probability that it is either a spade or an ace.	Apply	Learner to recall the concepts of theorem of probability to find the solution.	CO 1

9	In a bolt factory machines A, B, C manufactured $20\%, 30\%$ and 50% of the total. Of their output $6\%, 3\%$ and 2% are defective. A bolt is withdrawn at random and found to be defective. find the probabilities that it is manufactured from (i) Machine A (ii) Machine B (iii) Machine C.	Apply	Learner to recall the concepts of Bayes theorem to find the solution.	CO 1
10	A business man goes to hotels $X, Y, Z, 20\%, 50\%, 30\%$ of the time respectively. It is known that $5\%, 4\%, 8\%$ of the rooms in X, Y, Z hotels have faulty plumbings. What is the probability that business man's room having faulty plumbing id assigned to hotel Z	Apply	Learner to recall the concepts of Bayes theorem to find the solution.	CO 1
11	If $P(A) = \frac{1}{2}, P(B) = \frac{1}{3}$ and $P(A \cap B) = \frac{1}{5}$, then find $(i) P(A \cup B)$ $(ii) P(\bar{A} \cap B)$ (iii) $P(A \cap \bar{B})$ (iv) $P(\bar{A} \cap \bar{B})$	Apply	Learner to recall the concepts of theory of probability to find the solution.	CO 1
12	From six gentle men and four ladies , a committee of five is to be formed.Find the probability that this can be done so as to always include atleast one lady.	Apply	Learner to recall the concepts of theory of probability to find the solution.	CO 1
13	The chance that doctor A will diagnose x correctly is 60% .The chance that a patient will die by his treatment after correct diagnosise is 40% and the chance of death by wrong diagnosise is 70%.A patient of doctor A ,who had disease x,died.What is the chance that his disease was diagnoised correctly.	Apply	Learner to recall the concepts of theory of probability to find the solution.	CO 1

14	A bag contains 5 white,7 black and 4 red balls ,if three balls are drawn in random.Find the probability that a) All are different b)All are same c)2 balls are same and one is different.	Apply	Learner to recall the concepts of theory of probability to find the solution.	CO 1
15	In neighbourhood,90% children were falling sick due fle and 10% due to measles and no other disease.The probability of obseeming rashes for measles is 0.95 and for flu is 0.08. If a child develops rashes,find the child's probability of having flu.	Apply	Learner to recall the concepts of theory of probability to find the solution.	CO 1
16	In a class there are 10 boys and 5 girls.A committee of 4 students are to be selected from the class. Find the probability for the committee to contain atleast three girls.	Apply	Learner to recall the concepts of theory of probability to find the solution.	CO 1
17	Suppose 5 men out of 100 and 25 women out of 10,000 are color blind. A color blind person is chosen at random. What is the probability of the person being a male.	Apply	Learner to recall the concepts of Bayes theorem to find the solution.	CO 1
18	In a certain college , 4% of men and 1% of women are taller than 1.8m. further more 60% of the students are women.Now,if a student is selected at random and is taller than 1.8m., What is the probability that the student is a women?	Apply	Learner to recall the concepts of Bayes theorem to find the solution.	CO 1
19	A can hit a target 3 times in 5 shots,B can hit a target 2 times in 5 shots and C ,3 times in 4 shots . Find the probability of the target being hit ,when all of them try .	Apply	Learner to recall the concepts of addition theorem to find the solution.	CO 1

20	It is observed that 50% of mails are spam.There is a software that filtees spam mail before reaching the inbox.If acceuraly for detecting a spam mail is 99% and chances of tagging a non-spam mail as spam mail is 5%. If a ceartain mail is tagged as spam.Find the probability that it is not a spam mail.	Apply	Learner to recall the concepts of multiplication theorem to find the solution.	CO 1

PART-C SHORT ANSWER QUESTIONS				
1	State the classical definition of probability?	Remember	—	CO 1
2	What is the chance that a leap-year selected at random contains 53 sundays.	Understand	—	CO 1
3	If a coin is tossed twice then find probability of getting at least one head.	Understand	—	CO 1
4	A bag contains three red balls, 4 white balls and 7 black balls. Find the probability of drawing red or black ball.	Understand	—	CO 1
5	A coin is tossed n times then the probability that the head will present itself an odd number of times.	Understand	—	CO 1
6	Two cards are drawn at random from a pack of 52 cards. Find the pprobability of these two being aces.	Understand	—	CO 1
7	Define conditional probability.	Remember	—	CO 1
8	State multiplication theorem on probability for three events.	Remember	—	CO 1
9	State addition theorem on probability for three events.	Remember	—	CO 1
10	Six boys and six girls sit round a table randomly. Find the probability that all the six girls sit together.	Understand	—	CO 1
11	Find the chance that a non leap-year contains 53 Mondays.	Understand	—	CO 1
12	State Bayes Theorem	Remember	—	CO 1
13	Define Random Experiment with an example.	Remember	—	CO 1
14	Define exhaustive outcomes in an experiment with two examples.	Remember	—-	CO 1
15	Define Mutually exclusive events with an example.	Remember	—	CO 1

16	Define simple and complex events with examples.	Remember	—-	CO 1
17	State the classical definition of probability. If a fair coin is tossed six times. Calculate the probability of getting four heads.	Remember	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.	CO 1
18	State the limitations of classical definition of probability.	Remember	—	CO 1
19	Outline the classical definition of probability. A coin is tossed 9 times. Calculate the probability of getting 5 heads.	Understand	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.	CO 1
20	State the axioms of probability.	Remember	—	CO 1
MODULE II				
RANDOM VARIABLES				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	The probability density function of a random variable X is Calculate the value of f(x)= $\begin{cases} 3x^2, 0 < x < 1 \\ 0, otherwise \end{cases}$ calculate the value a, if $P(a \leq x \leq 1) = \frac{19}{81}$	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 2

2	The daily consumption of electric power (in millions of kW-hours) is a random variable having the probability density function f(x)=$\begin{cases} \frac{1}{9}xe^{\frac{-x}{3}}, x > 0 \\ 0, otherwise \end{cases}$ 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 2
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 discrete random variable and use it to calculate the discrete range probabilities, expected values.	CO 2
4	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.	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 2
5	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.	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 2

6	The function f (x)= Ax^2, in 0< x<1 is valid probability density function then Calculate the value of A.	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 2
7	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).	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 2
8	If E[X] = 10, V(X)=1, then Calculate E(2X(X+10)).	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 expected values.	CO 2
9	A discrete random variable X has the following probability distribution. Calculate (i) k (ii) P(X<3) (iii)P (X > 5).	Understand	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 2

x	1	2	3	4	5	6	7	8
P(X)	2k	4k	6k	8k	10k	12k	14k	4k

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 2
PART-B LONG ANSWER QUESTIONS				
1	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.	Understand	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 2
2	Let X denotes the number of heads in a single toss of 4 fair coins. Determine P(X<2) ii) P(1<X≤3)	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 2
3	A random variable X has the following probability function. Calculate (i) Expectation (ii) variance (iii) Standard deviation.	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 2

x	-1	0	1	2	3
P(X)	0.3	0.1	0.1	0.3	0.2

4	Find the mean and variance of the uniform probability distribution given by P(x)= 1/n for x=1,2,3,...,n.	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 2
5	A random variable X has the following probability function. Calculate (i) Expectation (ii) variance (iii) Standard deviation.	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 2

x	8	12	16	20	24
P(X)	1/8	1/6	3/8	1/4	1/12

6	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?	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 2

7	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.	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 2
8	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)?	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 2
9	If probability density function . f(x)= $\begin{cases} kx^3, 0 \leq x \leq 3 \\ 0, otherwise \end{cases}$ Calculate the value of K and Calculate the probability between x=1/2 and x=3/2.	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 2
10	A random variable x has the following probability function: Calculate (i) k (ii) P(x<6) (iii) P(X≥6)	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 2

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

11	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.	Understand	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 2
12	A random variable X has the following probability function: Then Calculate (i) k (ii) mean (iii) variance.	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 2

x	-3	-2	-1	0	1	2	3
P(X)	k	0.1	k	0.2	2k	0.4	2k

13	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.	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 2
14	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($x > 0.5$).	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 2

15	A random variable X has the following probability function. Calculate (i) Expectation (ii) variance (iii) Standard deviation.	Understand	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 2
	x: 4, 5, 6, 8 P(X): 0.1, 0.3, 0.4, 0.2			
16	If X is a Continuous random variable whose density function is $f(x)=\begin{cases} x, if \quad 0 < x < 1 \\ (2-x), 1 \leq x < 2, \\ 0 \quad elsewhere \end{cases}$ Evaluate E($25X^2$+30X-5).	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 2
17	The cumulative distribution function for a continuous random variable X is $f(x)=\begin{cases} 1-e^{-2x}, if \quad x \geq 0 \\ 0, x < 0 \end{cases}$ Evaluate (i) density function f(x) (ii) Mean and (iii) Variance of the density function.	Apply	Learner to recall the concept of a continuous random variable and explain the properties of probability distributive function of a continuous random variable and use it to calculate the continuous range probabilities, expected values.	CO 2
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 2

19	Is the function defined by $f(x)=\begin{cases} 0, if \quad x < 2 \\ \frac{(2x+3)}{18}, 2 \leq x \leq 4, \\ 0, \quad x > 4 \end{cases}$ a probability density function? Estimate the probability that a variate having f(x) as density function will fall in the interval $2 \leq x \leq 3$.	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 2
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 2
PART-C SHORT ANSWER QUESTIONS				
1	State the classical definition of probability?	Remember	—	CO 2
2	If E(X) = 6 and $E(X^2)$= 100 find the variance.	Understand	—	CO 2
3	If three coins are thrown at a time and X denotes the random variable which is defined as X(x) = no of heads, write its probability distribution table.	Understand	—	CO 2
4	If E(X) = 7, $E(X^2)$= 40, find the value of $E(5X^2 - 11x + 8)$	Apply	—	CO 2
5	State the definitions of discrete and continuous random variables with a suitable example.	Understand	—	CO 2
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.	Understand	—	CO 2
8	State the definition of mathematical expectation of a probability distribution function	Remember	—	CO 2
9	State the definition of the Mean and Variance of a probability mass function.	Remember	—	CO 2
10	State the definition of the Mean and Variance of a probability density function.	Remember	—	CO 2
11	Find the probability distribution for sum of scores on dice if we throw two dice.	Understand	—	CO 2
12	Out of 24 mangoes, 6 mangoes are rotten. If two mangoes drawn at random, obtain probability distribution of number of rotten mangoes that can be drawn. also find the expectation	Understand	—	CO 2
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 2
14	Show that $\sigma^2 = E(X^2) - \mu^2$.	Understand	Learner to Explain the concept of variance of a random variable and Prove	CO 2
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^2 V(X).	Understand	Learner to Explain the concept of variance of a random variable and Prove that V[aX+b]=a^2 V(X).	CO 2

17	State the classical definition of probability. If a fair coin is tossed six times. Calculate the probability of getting four heads.	Understand	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.	CO 2
18	State the definition of different types of random variables with example.	Remember	—	CO 2
19	Outline the classical definition of probability. A coin is tossed 9 times. Calculate the probability of getting 5 heads.	Understand	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.	CO 2
20	State the definition of random variable with an example.	Remember	—	CO 2
MODULE III				
PROBABILITY DISTRIBUTIONS				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Show that the Poisson distribution is a limiting case of Binomial distribution.	Apply	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.	CO 3
2	Derive the mean and variance of the Poisson distribution.	Apply	Learner to recall the definition of Poisson distribution and outline the proof of variance of Poisson distribution	CO 3
3	Explain the properties of Binomial distribution. Obtain the formula for mean of Binomial Distribution.	Remember	Learner to recall the definition of Binomial distribution and Outline the proof of mean of binomial distribution.	CO 3

4	The variance and mean of a binomial variable X with parameters n and p are 3 and 4. Calculate i) P(X=1) ii) $P(X \geq 1)$ iii) $P(0<X<3)$.	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 3
5	Calculate the expected frequencies of the Binomial distribution to the following data	Apply	Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required frequencies.	CO 3

x	0	1	2	3	4	5	6
f	13	25	52	58	32	16	4

CIE-II

6	Explain the properties of normal distribution. Obtain the Mean of Normal distribution.	Remember	Learner to recall the definition of Normal distribution and Illustrate the properties of Normal curve and derive the mean of normal distribution.	CO 4
7	Explain the properties of normal distribution. Determine the Mode in Normal distribution.	Remember	Learner to recall the definition of Normal distribution and Illustrate the properties of Normal curve and derive the mode of normal distribution.	CO 4
8	Derive the median of the Normal distribution and Explain the properties of normal distribution.	Apply	Learner to recall the definition of Normal distribution and Illustrate the properties of Normal curve and derive the median of normal distribution.	CO 4

9	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.	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 standard deviation.	CO 4
10	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.	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 standard deviation.	CO 4
PART-B LONG ANSWER QUESTIONS				
1	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) .	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 3
2	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.	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 3
3	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.	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 3

<table>
<tr><td>4</td><td>In 1000 sets of trials per an event of small probability the frequencies the successes are given below. 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 3</td></tr>
<tr><td colspan="5"><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></td></tr>
<tr><td>5</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 3</td></tr>
<tr><td>6</td><td>Out of 800 families with 5 children each, calculate how many would you expect to have (i)3 boys (ii)5 girls (iii)either 2 or 3 boys? Assume equal probabilities for boys and girls.</td><td>Understand</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 3</td></tr>
<tr><td>7</td><td>If a Poisson distribution is such that then Calculate P(x=1) $= \frac{3}{2}P(x=3)$ then calculate (i) $P(X \geq 1)$
(ii)$P(X \leq 3)$
(ii)$P(2 \leq X \leq 5)$.</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 3</td></tr>
<tr><td>8</td><td>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.</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 3</td></tr>
</table>

<table>
<tr><td>9</td><td>Calculate the expected frequencies Using Binomial Dis-
tribution 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 3</td></tr>
<tr><td>10</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 3</td></tr>
<tr><td colspan="5">CIE-II</td></tr>
<tr><td>11</td><td>The marks obtained in mathematics by 1000 students is normally distributed with mean 78% and standard deviation 11% .Determine i)How many students got marks above 90%. ii) What was the highest mark obtained by the lowest 10% of the students .iii) Within what limits did the middle of 90% of the students lie.</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 4</td></tr>
<tr><td>12</td><td>800 male students weights are normally distributed with mean 140 pounds and standard deviation 10 pounds.Find the number of students whose weight are i)between 138 and 148 pounds ii) more than 152 pounds.</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 4</td></tr>
</table>

13	For a normally distributed variate with mean 1 and standard deviation 3. Calculate $i)P(3.43 \leq X \leq 6.19)$ $ii)P(-1.43 \leq X \leq 6.19)$.	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 4
14	If X is a normal variate with mean 30 and standard deviation 5. Calculate the probabilities that $i)P(26 \leq x \leq 40)$ $ii)P(X \geq 45)$.	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 4
15	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 4
16	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 4
17	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 4

18	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 4
19	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	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 4
20	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? ii) How many students get more than 40? iii) How many students get below 20? iv) How many students get more than 50.	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 4

PART-C 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 3
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 3
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.	Understand	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 3
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 3
5	Interpret the properties of Binomial distribution.	Remember	Learner to Define the binomial distribution and explain its properties and parameters.	CO 3
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 3

7	Explain the properties of Poisson distribution.	Remember	Learner to Define the Poisson distribution and explain its properties and parameters.	CO 3
8	Build the binomial distribution for which the mean is 4 and variance 3	Understand	Learner to recall the definition of Binomial distribution and explain the properties of Binomial distribution and use Binomial formula to calculate the required parameters.	CO 3
9	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 3
10	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 3
CIE-II				
11	The mean and variance of a binomial distribution are 4 and 4/3 respectively. Then Calculate P(x=1).	Understand	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 3
12	In eight throws of a die 5 or 6 is considered a success. Calculate the mean number of success	Understand	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 3

13	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.	Understand	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 3
14	State the formulae of Mean, Variance of Poisson distribution	Remember	—	CO 3
15	State the formulae of mode of a Binomial distribution.	Remember	—	CO 3
16	State the formulae of mean, variance of Binomial distribution.	Remember	—	CO 3
17	Explain the properties of Poisson distribution. Derive the recurrence relation for the Poisson distribution.	Remember	Learner to Define the Poisson distribution and explain its properties and use it to derive the recurrence relation.	CO 3
18	Illustrate the properties of the Normal curve.	Remember	Learner to recall the definition of Normal distribution and Illustrate the properties of Normal curve.	CO 4
19	Explain the properties of normal distribution.	Understand	Learner to Define the Normal distribution and explain its properties and parameters.	CO 4
20	If X is normally distributed with mean 2 and variance 0.1, then Calculate $P(\|x-2\| \geq 0.01)$?	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 4

MODULE IV				
CORRELATION AND REGRESSION				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Calculate coefficient of correlation between X and Y for the following data.	Apply	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.	CO 5

X	10	12	18	24	23	27
Y	13	18	12	25	30	10

2	Ten competitors in a musical test were ranked by the three judges A, B and C in the following order. Using rank correlation method, estimate which pair of judges has the nearest approach to common likings in music.	Apply	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.	CO 5

Rank A	1	6	5	10	3	2	4	9	7	8
Rank B	3	5	8	4	7	10	2	1	6	9
Rank C	6	4	9	8	1	2	3	10	5	7

3	Interpret the properties of rank correlation coefficient. Obtain the rank correlation coefficient for the following data.	Apply	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.	CO 5

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	68	45	81	60	68	48	50	70

4	Show that the coefficient of correlation lies between -1 and 1.	Apply	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.	CO 5

5	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. (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.	Apply	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.	CO 5
6	Outline the proof of the formula for angle between two regression lines.	Apply	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.	CO 5
7	If σ_x=σ_y=σ and the angle between the regression lines are $\theta = Tan^{-1}(3)$.Outline the formula of angle between two regression lines. Obtain r.	Apply	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.	CO 5
8	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 tanθ .	Apply	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.	CO 5
9	Outline the formulae of regression lines. Calculate the value of y when x =12 from the following data:	Apply	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.	CO 5

	X	Y
Average	7.6	14.8
Standard deviation	3.6	2.5
Coefficient of correlation	0.99	-

10	Construct the regression equation of Y on X from the data given below, taking deviations from actual means of X and Y. Estimate the likely demand when the price is Rs. 20.	Apply	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.	CO 5

Price (Rs.)	10	12	13	12	16	15
Amount demanded	40	38	43	45	37	43

PART-B LONG ANSWER QUESTIONS

1	A random sample of 5 college students is selected and their grades in mathematics and statistics are found to be Calculate Spearman's rank correlation coefficient.	Apply	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.	CO 5

	1	2	3	4	5
Mathematics	85	60	73	40	90
Statistics	93	75	65	50	80

2	Calculate the coefficient of correlation from the following data	Apply	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.	CO 5

x	12	9	8	10	11	13	7
y	14	8	6	9	11	12	13

3	Explain the properties of rank correlation coefficient. The following data gives the marks in obtained by 10 students in accountancy and statistics. Where R: roll number, A: accountancy, S: statistics. Calculate the coefficient of correlation.	Apply	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.	CO 5

R	1	2	3	4	5	6	7	8	9	10
A	45	70	65	30	90	40	50	75	85	60
S	35	90	70	40	95	40	80	80	80	50

4	Calculate the Karl Pearson's coefficient of correlation from the following data. Where W: wages and C: cost of living.	Apply	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.	CO 5

W	100	101	102	102	100	99	97	98	96
C	98	99	99	97	95	92	95	94	90

5	Explain the properties of rank correlation coefficient. Calculate a suitable coefficient of correlation for the following data: Where F: Fertilizer used(tones) and P: Productivity (tones)	Apply	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.	CO 5

F	15	18	20	24	30	35	40	50
P	85	93	95	105	120	130	150	160

6	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. Where A: age intervals, N: No of persons in thousands and B: no of blind persons.	Apply	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.	CO 5

A	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
N	100	60	40	36	24	11	6	3
B	55	40	40	40	36	22	18	15

7	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?	Apply	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.	CO 5

S	1	2	3	4	5	6	7	8	9	10
M	2	4	1	5	3	9	7	10	6	8

8	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.	Apply	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.	CO 5
9	A sample of 11 fathers and their elder sons gave the following data about their elder sons. Calculate the coefficient of correlation. Where F: Father's height in inches and S:Son's height in inches.	Apply	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.	CO 5

F	65	63	67	64	68	62	70	66	68	69	71
S	68	66	68	65	69	66	68	65	71	68	70

10	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?	Apply	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.	CO 5

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<tr><td colspan="5">
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<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>
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</td></tr>
<tr><td>11</td><td>Outline the formulae of regression lines. Calculate the regression equation which best fit to the following data:</td><td>Apply</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 5</td></tr>
<tr><td colspan="5">
<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></tr>
<tr><td>12</td><td>In the following table S is weight of Potassium bromide which will dissolve in 100 grams. Of water at V^o C. 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>
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<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>Apply</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 5</td></tr>
<tr><td>14</td><td>Outline the formula of angle between two regression lines. If σ_x=σ_y=σ and the angle between the regression lines is $\theta = Tan^{-1}\left(\frac{4}{3}\right)$, calculate r.</td><td>Apply</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 5</td></tr>
</table>

15	Outline the formulae of regression lines. Calculate both regression lines which best fit to the following data: Also, i) find y when x= 13.ii) find x when y = 11.5	Apply	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.	CO 5

x	2	4	6	8	10	12	14
y	4	2	5	10	4	11	12

16	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.	Apply	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.	CO 5
17	Outline the formulae of regression lines. Calculate the most likely production corresponding to a rainfall 40 from the following data:	Apply	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.	CO 5

	Rain fall (X)	Production(Y)
Average	30	500Kgs
Standard deviation	5	100 Kgs
Coefficient of correlation	0.8	-

18	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. Where F: Mother's height in inches and D: Daughter's height in inches.	Apply	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.	CO 5

M	62	63	64	64	65	66	68	70
D	64	65	61	69	67	68	71	65

19	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: 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.	Apply	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.	CO 5

Performance	1	2	3	4	5	6	7
Marks by P	46	42	44	40	43	41	45
Marks by Q	40	38	36	35	39	37	41

20	Given the bi-variate data Using regression lines i) find y when x= 10.ii) find x when y = 2.5	Apply	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.	CO 5

X	1	5	3	2	1	1	7	3
Y	6	1	0	0	1	2	1	5

PART-C SHORT ANSWER QUESTIONS

1	State the definition of correlation coefficient.	Apply	–	CO 5
2	List out the types of correlation.	Apply	–	CO 5
3	Given n = 12,$\sigma_x = 2.5$ and $\sigma_y = 3.6$ sum of the product of deviation from the mean of X and Y is 64 Calculate the correlation co-efficient.	Apply	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 5

4	State the formula of rank correlation coefficient.	Apply	–	CO 5
5	State the properties of correlation coefficient.	Apply	–	CO 5
6	If $\sum XY = 216$, $\sum X^2 = 102$, $\sum Y^2 = 471$ then Calculate correlation coefficient.	Apply	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 5
7	Given n=10, $\sigma_x = 5.4$ and $\sigma_y = 6.2$ sum of product of deviations from the mean of X and Y is 66 Calculate the correlation co-efficient.	Apply	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 5
8	State the properties of rank correlation coefficient.	Apply	–	CO 5
9	From the following data calculate (i) correlation coefficient (ii) standard deviation of y. $b_{xy} = 0.85$, $b_{yx} = 0.89$ and $\sigma_x = 3$	Apply	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 5
10	If N=8, $\sum X = 544$, $\sum Y = 552$, $\sum XY = 37560$ then Calculate COV (X, Y).	Apply	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 5

11	The equations of two regression lines are 7x-16y+9=0, 5y-4x-3=0. Calculate the coefficient of correlation.	Apply	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 5
12	State the formulae of normal equations for regression lines?	Apply	—	CO 5
13	State the formula of angle between two regression lines	Apply	—	CO 5
14	Find the means of X and Y variables from the following two regression equations: 2Y–X–50 = 0, 3Y–2X–10 = 0	Apply	—	CO 5
15	Find the coefficient of correlation between X and Y variables from the following two regression equations: 2Y–X–50 = 0 3Y–2X–10 = 0	Apply	—	CO 5
16	Find the means of X and Y variables from the following two regression equations: 4X–5Y+33 = 0 20X–9Y–107 = 0	Apply	—	CO 5
17	Find the coefficient of correlation between X and Y variables from the following two regression equations: 4X–5Y+33 = 0 20X–9Y–107 = 0	Apply	—	CO 5
18	State the properties of regression lines.	Remember	—	CO 5
19	List the differences between correlation and regression.	Apply	—	CO 5
20	$\sum X = 15$, $\sum Y = 25$, $\sum X^2 = 55$, $\sum Y^2 = 135$, $\sum XY = 83$ and N = 5 find the regression coefficient of y on x.	Apply	—	CO 5

MODULE V				
TESTING OF HYPOTHESIS				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	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 6
2	A manufacturer claims that at least 95% of the equipment which he supplied to a factory confirmed 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 6
3	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 6
4	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.	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 6

5	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. 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.	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 6

H	117	105	97	105	123	109	86	78	103
W	106	98	87	104	116	95	90	69	108

6	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.	Apply	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.	CO 6
7	From the following data, calculate whether there is any significant liking in the habit of taking soft drinks among the categories of employees.	Apply	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.	CO 6

Soft drinks	Clerks	Teachers	officers
Pepsi	10	25	65
Thumbs up	15	30	65
Fanta	50	60	30

8	In an investigation on the machine performance, the following results are obtained. Examine whether the performance of the machines is independent or not by using chi square test at 5% LOS.	Apply	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.	CO 6

	No of units inspected	No of defective
Machine1	375	17
Machine2	450	22

9	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.	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 6

	Mean	Standard Deviation	Sample Size
University A	55	10	10
University B	57	15	20

10	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.	Apply	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.	CO 6

Unit- A	14.1	10.1	14.7	13.7	14.0
Unit - B	14.0	14.5	13.7	12.7	14.1

PART-B LONG ANSWER QUESTIONS				
1	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 6
2	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 6
3	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 6
4	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: $\mu > 73.2$.	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 6

5	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 6
6	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.	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 6
7	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.	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 6
8	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.	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 6

	Mean	Standard Deviation	Sample Size
University A	55	10	400
University B	57	15	100

9	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?	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 6
10	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?	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 6
11	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?	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 6
12	Two random samples gave the following results. Examine whether the samples came from the same population or not?	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 6

Sample	size	Sample mean	Sum of squares of deviations from mean
I	10	15	90
II	12	14	108

13	Two independent samples of items are given respectively had the following values. Examine whether there is any significant difference between their means?	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 6

Sample I	11	11	13	11	15	9	12	14
Sample II	9	11	10	13	9	8	10	-

14	Time taken by workers in performing a job by method 1 and method 2 is given below. Does the data show that variances of time distribution from population which these samples are drawn do not differ significantly?	Apply	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.	CO 6

Method 1	20	16	27	23	22	26	-
Method 2	27	33	42	35	32	34	38

15	A die is thrown 264 times with the following results. Prove that the die is unbiased.	Apply	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.	CO 6

No appeared-on die	1	2	3	4	5	6
Frequency	40	32	28	58	54	52

16	200 digits were chosen at random from set of tables the frequency of the digits is 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.	Apply	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.	CO 6

d	0	1	2	3	4	5	6	7	8	9
f	18	19	23	21	16	25	22	20	21	15

17	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?	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 6
18	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?	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 6
19	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.	Apply	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.	CO 6
20	The following random samples are measurements of the heat-producing capacity (in millions of calories per ton) of specimens of coal from two mines: Use the 0.05 level of significance to Examine whether it is reasonable to assume that the variances of the two populations are equal.	Apply	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.	CO 6

Mine 1	8,260	8,130	8,350	8,070	8,340	...
Mine 2	7,950	1,890	7,900	8,140	7,920	7,840

PART-C SHORT ANSWER QUESTIONS				
1	State the definition of population? Give an example.	Apply	—	CO 6
2	State the definition of sample? Give an example.	Apply	—	CO 6
3	State the definition of parameter and statistic.	Apply	—	CO 6
4	State the definition of standard error of a statistic.	Apply	—	CO 6
5	In a manufacturing company out of 100 goods 25 are top quality. Find sample proportion.	Apply	—	CO 6
6	Find the confidence interval for single proportion if 18 goods are defective from a sample of 200 goods.	Apply	—	CO 6
7	Find the sample proportion in one day production of 400 articles only 50 are top quality.	Apply	—	CO 6
8	State the formula for difference of means in large samples.	Apply	—	CO 6
9	State the formula of test statistic for difference of proportions in large samples.	Apply	—	CO 6
10	If $\bar{x}$ =47.5, μ= 42.1, s=8.4,n=24 then Find t.	Apply	—	CO 6
11	If $\bar{x}$ =40, μ= 25, s=8.4,n=24 then Find t.	Apply	—	CO 6
12	State the definition of the statistic for t test for single mean?	Apply	—	CO 6
13	State the definition of degree of freedom.	Apply	—	CO 6
14	Find $F_{0.05}$ with (7, 8) degrees of freedom.	Apply	—	CO 6
15	Find $t_{0.05}$ when 16 degrees of freedom.	Apply	—	CO 6
16	State the definition of the statistic for t test for difference of means?	Apply	—	CO 6

17	State the formula of the degree of freedom for t test for difference of means?	Apply	—	CO 6
18	State the definition of the statistic for F test?	Apply	—	CO 6
19	State the formula of the degree of freedom for chi square test for contingency table of order 4x3?	Apply	—	CO 6
20	State the Formula of statistic for chi square test?	Apply	—	CO 6

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