



SRM VALLIAMMAI ENGINEERING COLLEGE



SRM Nagar, Kattankulathur – 603 203.

(An Autonomous Institution)

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

QUESTION BANK



I SEMESTER

MA3128 – ADVANCED MATHEMATICS FOR COMPUTER SCIENCE AND ENGINEERING

Regulations – 2023

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SRM VALLIAMMAI ENGINEERING COLLEGE

DEPARTMENT OF MATHEMATICS

QUESTION BANK

SUBJECT : MA3128 – ADVANCED MATHEMATICS FOR COMPUTER SCIENCE AND ENGINEERING

SEM / YEAR : I / I year M.E. (CSE)

UNIT I -LINEAR ALGEBRA - Vector spaces – Norms – Inner Products - QR factorization - Generalized Eigen vectors - Singular value decomposition and applications – Pseudo inverse - Least squares approximations.				
Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
PART – A				
1.	Define Inner Product of a vector space.	BTL -1	Remembering	CO 1
2	Define Subspace of a vector space	BTL -2	Understanding	CO 1
3	Define norm of a vector space.	BTL -2	Understanding	CO 1
4	Define vector space with example	BTL -1	Remembering	CO 1
5	In a Vector Space $V(F)$ if $\alpha v=0$ then either $\alpha=0$ or $v=0$ prove.	BTL -2	Understanding	CO 1
6	Is $\{(1,4,-6), (1,5,8), (2,1,1), (0,1,0)\}$ is a linearly independent subset of R^3 ? Justify your answer	BTL -1	Remembering	CO 1
7.	Find the sum and product of all Eigen values of $\begin{bmatrix} 1 & 2 & -2 \\ 1 & 0 & 3 \\ -2 & -1 & -3 \end{bmatrix}$	BTL -2	Understanding	CO 1
8.	Describe Least square method.	BTL -1	Remembering	CO 1
9	Find the least square solution to the system $x_1 + x_2 = 3, -2x_1 + 3x_2 = 1$ and $2x_1 - x_2 = 2$	BTL -2	Understanding	CO 1
10	Define Hermitian Matrix.	BTL -1	Remembering	CO 1
11	Write short note on Singular value decomposition of complex matrix A.	BTL -1	Remembering	CO 1
12	State Singular value decomposition theorem.	BTL -1	Remembering	CO 1
13	If A is a nonsingular matrix, then what is A^+ ?	BTL -2	Understanding	CO 1

14.	If the sum of two eigenvalues and trace of a 3x3 matrix A are equal find the value of $ A $.	BTL -1	Remembering	CO 1
15.	Let $A = \begin{pmatrix} 1 & 1 \\ 1 & 3 \end{pmatrix} = A_1$. Compute A_2 using QR algorithm.	BTL -2	Understanding	CO 1
16.	Discuss the nature of the quadratic form $6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4zx$.	BTL -2	Understanding	CO 1
17.	Define the generalized Eigen vector, chain of rank m, for a square matrix.	BTL -2	Understanding	CO 1
18.	Find the sum and product of the Eigen values of the matrix $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 2 & 1 \\ -7 & 2 & -3 \end{bmatrix}$.	BTL -1	Remembering	CO 1
19.	Check whether the given matrix is positive definite or not $\begin{pmatrix} 3 & 1 & -1 \\ 1 & 3 & -1 \\ -1 & -1 & 5 \end{pmatrix}$	BTL -1	Remembering	CO 1
20.	Give the nature of quadratic form without reducing into canonical form $x_1^2 - 2x_1x_2 + x_2^2 + x_3^2$	BTL -1	Remembering	CO 1
21.	The sum of two Eigen values of a 3x3 matrix is equal to trace of a matrix then find $ A $	BTL -2	Understanding	CO 1
22.	Determine the canonical basis for $A = \begin{bmatrix} 3 & 5 \\ -2 & -4 \end{bmatrix}$.	BTL -1	Remembering	CO 1
23.	Give the nature of the quadratic form without converting whose matrix is $\begin{pmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -2 \end{pmatrix}$.	BTL -2	Understanding	CO 1
24.	Find the sum and product of $\begin{bmatrix} 1 & 1 & -1 \\ 1 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$	BTL -1	Remembering	CO 1
25.	Write down the matrix of the quadratic form $2x^2 + 8z^2 + 4xy + 10xz - 2yz$	BTL -2	Understanding	CO 1
PART – B				
1.	Determine whether the following set is linearly dependent or linearly independent $\left(\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}, \begin{pmatrix} 0 & -1 \\ 1 & 1 \end{pmatrix}, \begin{pmatrix} -1 & 2 \\ 1 & 0 \end{pmatrix}\right)$ and $\begin{pmatrix} 2 & 1 \\ 2 & -2 \end{pmatrix}$ generate $M_{2 \times 2}(R)$	BTL -3	Applying	CO 1
2.	If x, y and z are vectors in a vector space V such that $x + z = y + z$, then prove that $x = y$ i) The additive identity for any $x \in V$ is unique ii) The additive inverse is unique	BTL -2	Understanding	CO 1
3.	Show that the set $S = \{(1, 3, -4, 2), (2, 2, -4, 0), (1, -3, 2, -4), (-1, 0, 1, 0)\}$ is linearly dependent of the other vectors	BTL -3	Applying	CO 1
4(a)	Determine whether the following subset of vector space $R^3(R)$ is a subspace $W_1 = \{((a_1, a_2, a_3): 2a_1 - 7a_2 + a_3 = 0)\}$	BTL -3	Applying	CO 1

4(b)	Illustrate that set of all diagonal matrices of order $n \times n$ is a subspace of the vector space $M_{n \times n}(F)$, where $M_{n \times n}$ is the set of all square matrices over the field F	BTL -3	Applying	CO 1
5.	Find the QR factorization of $A = \begin{pmatrix} 3 & 2 \\ 4 & 5 \end{pmatrix}$.	BTL -2	Understanding	CO 1
6.	Find the QR factorization of $A = \begin{bmatrix} 0 & 0 & 5 \\ 0 & 4 & 1 \\ 1 & 1 & 1 \end{bmatrix}$	BTL -4	Analyzing	CO 1
7.	Find the QR factorization of $A = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$	BTL -4	Analyzing	CO 1
8.	Obtain the singular value decomposition of $\begin{pmatrix} 2 & 2 \\ -1 & 1 \end{pmatrix}$	BTL -3	Applying	CO 1
9.	Construct the singular value decomposition for $\begin{pmatrix} 1 & 1 & 3 \\ 1 & 1 & 3 \end{pmatrix}$	BTL -4	Analyzing	CO 1
10.	Obtain the singular value decomposition of $A = \begin{bmatrix} 2 & -1 \\ -2 & 1 \\ 4 & -2 \end{bmatrix}$	BTL -3	Applying	CO 1
11.	Obtain the singular value decomposition $\begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$	BTL -3	Applying	CO 1
12.	Find the least square line fitted to the data (1,1),(2,2),(3,2),(4,3).	BTL -3	Applying	CO 1
13.	Solve the following system of equations in the least square sense $x_1 + x_2 + x_3 = 1$; $x_1 + x_2 + x_3 = 2$; $x_1 + x_2 + x_3 = 3$.	BTL -4	Analyzing	CO 1
14.	Solve the following system of equations in the least square sense $2x_1 + 2x_2 - 2x_3 = 1$, $2x_1 + 2x_2 - 2x_3 = 3$, $-2x_1 - 2x_2 + 6x_3 = 2$	BTL -3	Applying	CO 1
15.	Fit a straight line in the least square sense to the following data X: -3 -2 -1 0 1 2 3 Y: 8 12 17 25 26 32 40	BTL -4	Analyzing	CO 1
16.	Fit a straight line in the least square sense to the following data X: -3 -2 -1 0 1 2 3 Y: 10 15 19 27 28 34 42	BTL -4	Analyzing	CO 1
17.	Find the eigen values and eigen vectors of the matrix $A = \begin{pmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{pmatrix}$	BTL -3	Applying	CO 1
18.	Find the Eigen values and Eigen vectors of the matrix $\begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$	BTL -4	Analyzing	CO 1

UNIT II ONE DIMENSIONAL RANDOM VARIABLES – Random variables – Moments – Moment generating function and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
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PART – A

PART – A											
1.	The number of hardware failures of a computer system in a week of operations has the following p.d.f, Find the mean of the number of failures in a week.							BTL-2	Understanding	CO 2	
	No.of failures	0	1	2	3	4	5				6
	Probability	.18	.28	.25	.18	.06	.04				.01
2.	The number of hardware failures of a computer system in a week of operations has the following p.d.f, Calculate the value of K.							BTL-2	Understanding	CO 2	
	No.of failures	0	1	2	3	4	5				6
	Probability	K	2 K	2 K	K	3 K	K				4 K
3.	Check whether the function given by $f(x) = \frac{x+2}{25}$ for $x=1,2,3,4,5$ can serve as the probability distribution of a discrete random variable.							BTL-2	Understanding	CO 2	
4.	If the random variable X takes the values 1,2,3 and 4 such that $2P(X = 1) = 3P(X = 2) = P(X = 3) = 5P(X = 4)$, find the probability distribution of X							BTL-1	Remembering	CO 2	
5.	The RV X has the following probability distribution:							BTL-2	Understanding	CO 2	
	x	-2	-1	0	1						
	P(x)	0.4	k	0.2	0.3						
Find k and the mean value of X											
6.	If $f(x) = K(x + x^2)$ in $1 < x < 5$ is a pdf of a continuous random variables. Find the value of K.							BTL-1	Remembering	CO 2	
7.	The p.d.f of a continuous random variable X is $f(x) = k(1 + x), 2 < x < 5$ Find k.							BTL-1	Remembering	CO 2	
8.	For a continuous distribution $f(x) = k(x - x^2), 0 \leq x \leq 1$, where k is a constant. Find k.							BTL-2	Understanding	CO 2	
9.	If $f(x) = kx^2, 0 < x < 3$, is to be a density function, find the value of k.							BTL-2	Understanding	CO 2	
10.	If the probability that a target is destroyed on any one shot is 0.5, Find the probability that it would be destroyed an 6 th attempt.							BTL-2	Understanding	CO 2	
11.	The mean of Binomial distribution is 20 and standard deviation is 4. Find the parameters of the distribution.							BTL-1	Remembering	CO 2	
12.	The mean and variance of binomial distribution are 5 and 4. Determine the distribution.							BTL2	Analyzing	CO 2	
13.	If 3% of the electric bulbs manufactured by a company are defective, Find the probability that in a sample of 100 bulbs exactly 5 bulbs are defective.							BTL-2	Understanding	CO 2	

14.	Messages arrive at a switchboard in a poisson manner at an average rate of six per hour. Find the probability for exactly two messages arrive within one hour.	BTL-2	Understanding	CO 2																		
15.	The number of monthly breakdowns of a computer is a random variable having Poisson distribution with mean 1.8. Find the probability that this computer will function for a month with only one breakdown.	BTL-1	Remembering	CO 2																		
16.	If X is a Poisson variate such that $2P(X = 0) + P(X = 2) = 2P(X = 1)$, find E(X)	BTL-2	Understanding	CO 2																		
17.	The probability that a candidate can pass in an examination is 0.6. What is the probability that he will pass in third trial?	BTL-1	Remembering	CO 2																		
18.	If $f(x) = \frac{x^2}{3}, -1 < x < 2$ is the pdf of the random variable X ,then find $p(0 < x < 1)$	BTL-2	Understanding	CO 2																		
19.	If the probability that an applicant for a driver's license will pass the road test on any given trial is 0.8, what is the probability that he will finally pass the test on the fourth trial	BTL-1	Remembering	CO 2																		
20.	If X has uniform distribution in (-3,3), find $P(x - 2 < 2)$	BTL-2	Understanding	CO 2																		
21.	Let X be a random variable with moment generating function $M_x(t) = \frac{(2e^t + 1)^4}{81}$.Find its mean and variance.	BTL-2	Understanding	CO 2																		
22.	A Random variable X is uniformly distributed between 3 and 15. Find the variance of X.	BTL-2	Understanding	CO 2																		
23.	A continuous RV X has the density function $ce^{-\frac{x}{5}}, x > 0$. Find c. Create E(x) and Var(X)	BTL-1	Remembering	CO 2																		
24.	If X is a normal random variable with mean 3 and variance 9, find the probability that X lies between 2 and 5.	BTL-1	Remembering	CO 2																		
25.	A normal distribution has mean $\mu = 20$ and standard deviation $\sigma = 10$. Evaluate $(15 \leq X \leq 40)$.	BTL-2	Understanding	CO 2																		
PART -B																						
1(a)	A random variable X has the following probability distribution:<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>P(X)</td><td>0</td><td>k</td><td>2 k</td><td>2 k</td><td>3 k</td><td>k²</td><td>2k²</td><td>7k²+k</td></tr></table>Find (i) the value of k (ii) $P(1.5 < X < 4.5 / X > 2)$	X	0	1	2	3	4	5	6	7	P(X)	0	k	2 k	2 k	3 k	k ²	2k ²	7k ² +k	BTL-2	Understanding	CO 2
X	0	1	2	3	4	5	6	7														
P(X)	0	k	2 k	2 k	3 k	k ²	2k ²	7k ² +k														
1(b)	Find the MGF of Binomial distribution and hence find its mean and variance	BTL-2	Understanding																			
2(a)	The probability mass function of a discrete R. V X is given in the following table:	BTL-2	Understanding																			

	<table><tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>P(X=x)</td><td>0.1</td><td>K</td><td>0.2</td><td>2k</td><td>0.3</td><td>k</td></tr></table> Find (1) Find the value of k, (2) P(X<1),(3) P(-1< X ≤ 2)	X	-2	-1	0	1	2	3	P(X=x)	0.1	K	0.2	2k	0.3	k			CO 2						
X	-2	-1	0	1	2	3																		
P(X=x)	0.1	K	0.2	2k	0.3	k																		
2(b)	Obtain the MGF of Poisson distribution and hence find its mean and variance	BTL-2	Understanding	CO 2																				
3(a)	The probability mass function of a discrete random variable X is given in the following table <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>8</td></tr><tr><td>P(X)</td><td>a</td><td>3a</td><td>5a</td><td>7a</td><td>9a</td><td>11a</td><td>13a</td><td>15a</td><td>17a</td></tr></table> Find (i) the value of a , (ii) P(X < 3), (iii) Mean of X, (iv) Variance of X.	X	0	1	2	3	4	5	6	7	8	P(X)	a	3a	5a	7a	9a	11a	13a	15a	17a	BTL-3	Applying	CO 2
X	0	1	2	3	4	5	6	7	8															
P(X)	a	3a	5a	7a	9a	11a	13a	15a	17a															
3(b)	Deduce the MGF of a geometric distribution and hence find the mean and variance	BTL-3	Applying	CO 2																				
4(a)	If the discrete random variable X has the probability function given by the table. <table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>P(x)</td><td>k/3</td><td>k/6</td><td>k/3</td><td>k/6</td></tr></table> Find the value of k and Cumulative distribution of X.	x	1	2	3	4	P(x)	k/3	k/6	k/3	k/6	BTL-3	Applying	CO 2										
x	1	2	3	4																				
P(x)	k/3	k/6	k/3	k/6																				
4(b)	Derive the MGF of Uniform distribution and hence deduce the mean and variance	BTL-3	Applying	CO 2																				
5(a)	If the probability mass function of a random variable X is given by P(X=x) = kx ³ , x=1,2,3,4. Find the value of k, mean and variance of X.	BTL-3	Applying	CO 2																				
5(b)	Deduce the MGF of Exponential distribution and hence find its mean and variance	BTL-3	Applying	CO 2																				
6(a)	Find the MGF , mean and variance of the random variable X has the pdf $f(x) = \begin{cases} x, 0 < x < 1 \\ 2 - x, 1 < x < 2 \\ 0, otherwise \end{cases}$	BTL-4	Analyzing	CO 2																				
6(b)	State and prove the memory less property of exponential distribution	BTL-3	Applying	CO 2																				
7(a)	In a large consignment of electric bulbs, 10 percent are defective. A random sample of 20 is taken for inspection. Find the probability that i) all are good bulbs ii) atmost there are 3 defective bulbs iii) exactly there are 3 defective bulbs.	BTL-2	Understanding	CO 2																				
7(b)	A manufacturer of pins knows that 2% of his products are defective. If he sells pins in boxes of 100 and guarantees that not more than 4 pins are defective, what is the probability that a box fail to meet the guaranteed quality.	BTL-3	Applying	CO 2																				

8.	Obtain the MGF of a normal distribution and hence find its mean and variance	BTL-4	Analyzing	CO 2
9(a)	If a random variable X has p.d.f $f(x) = \begin{cases} \frac{1}{4}, & X < 2 \\ 0, & \text{Otherwise} \end{cases}$ Find (a) $P(X < 1)$ (b) $P(X > 1)$ (c) $P(2X + 3 > 5)$.	BTL-4	Analyzing	CO 2
9(b)	Out of 2000 families with 4 children each, Find how many family would you expect to have i) at least 1 boy ii) 2 boys.	BTL-4	Analyzing	CO 2
10(a)	Find the MGF of the random variable X having the probability density function $f(x) = \begin{cases} \frac{x}{4} e^{-\frac{x}{2}}, & x > 0 \\ 0, & \text{otherwise} \end{cases}$. Also find the mean and variance	BTL-3	Applying	CO 2
10(b)	4 coins were tossed simultaneously. What is the probability of getting (i) 2 heads, (ii) at least 2 heads, (iii) at most 2 heads.	BTL-3	Applying	CO 2
11(a)	A random variable X has c.d.f $F(x) = \begin{cases} 0, & \text{if } x < -1 \\ a(1+x), & \text{if } -1 < x < 1 \\ 1, & \text{if } x \geq 1 \end{cases}$. Find the value of a. Also $P(X > 1/4)$ and $P(-0.5 \leq X \leq 0)$.	BTL-3	Applying	CO 2
11(b)	The atoms of a radioactive element are randomly disintegrating. If every gram of this element, on average, emits 3.9 alpha particles per second, then what is the probability that during the next second the number of alpha particles emitted from 1 gram is (1) at most 6 (2) at least 2 and (3) at least and at most 5	BTL-4	Analyzing	CO 2
12.	If $f(x) = \begin{cases} ax, & 0 \leq x \leq 1 \\ a, & 1 \leq x \leq 2 \\ 3a - ax, & 2 \leq x \leq 3 \\ 0, & \text{elsewhere} \end{cases}$ is the p.d.f of X. Calculate (i) The value of a, (ii) The cumulative distribution function of X (iii) If X_1, X_2 and X_3 are 3 independent observations of X. Find the probability that exactly one of these 3 is greater than 1.5?	BTL-3	Applying	CO 2
13(a)	The Probability distribution function of a R.V. X is given by $f(x) = \frac{4x(9-x^2)}{81}$, $0 \leq x \leq 3$. Find the mean, variance.	BTL-3	Applying	CO 2

13(b)	The number of monthly breakdowns of a computer is a random variable having a Poisson distribution with mean equal to 1.8. Find the probability that this computer will function for a month (1) without breakdown (2) with only one breakdown and (3) with at least one breakdown.	BTL-3	Applying	CO 2
14(a)	Messages arrive at a switch board in a Poisson manner at an average rate of 6 per hour. Find the probability that exactly 2 messages arrive within one hour, no messages arrives within one hour and at least 3 messages arrive within one hour	BTL-3	Applying	CO 2
14(b)	An electrical firm manufactures light bulbs that have a life, before burn out, that is normally distributed with mean equal to 800 hours and a standard deviation of 40 hours. Find the probability that a bulb burns between 778 and 834 hours.	BTL3	Applying	CO 2
15(a)	The time (in hours) required to repair a machine is exponentially distributed with parameter $\lambda = 1/2$. (a) What is the probability that the repair time exceeds 2 hours? (b) What is the conditional probability that a repair time exceeds at least 10 hours that its distribution exceeds 9 hours?	BTL4	Analyzing	CO 2
15(b)	Let X be a Uniformly distributed R. V. over [-5, 5]. Evaluate (i) $P(X \leq 2)$ (ii) $P(X > 2)$ (iii) Cumulative distribution function of X (iv) $\text{Var}(X)$	BTL4	Analyzing	CO 2
16(a)	Buses arrive at a specified stop at 15 minutes interval starting at 7am that is, 7,7:15,7:30,7:45, and so on, If a passenger arrives at the stop at a random time that is uniformly distributed between 7 and 7:30 am, evaluate the probability that he waits (a) Less than 5 minutes for a bus and (b) At least 12 minutes for a bus	BTL4	Analyzing	CO 2
16(b)	The marks obtained by a number of students for a certain subject is assumed to be normally distributed with mean 65 and standard deviation 5. If 3 students are taken at random from this set Find the probability that exactly 2 of them will have marks over 70?	BTL4	Analyzing	CO 2
17.	In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and Standard Deviation of 60 hours. Find the number of bulbs likely to burn for (i) more than 2150 hours (ii) less than 1950 hours and (iii) more than 1920 hours burs less than 2160 hours.	BTL3	Applying	CO 2
18(a)	The length of time a person speaks over phone follows exponential distribution with mean 6 mins. What is the	BTL3	Applying	CO 2

	probability that the person will talk for (1) more than 8 mins (2) between 4 and 8 mins.			
18(b)	A car hire firm has 2 cars. The number of demands for a car on each day is distributed as poisson variate with mean 0.5. Calculate the portion of days on which (1) Neither car is used (2) Some demand is refused.	BTL3	Applying	CO 2

UNIT – III TWO DIMENSIONAL RANDOM VARIABLES Joint distributions – Marginal and conditional distributions – Function of two dimensional random variables – Regression Curve – Correlation.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome									
PART – A													
1.	The joint probability distribution of X and Y is given by $p(x, y) = \frac{x + y}{21}$, $x = 1, 2, 3; y = 1, 2$. Find the marginal probability distributions of X	BTL-2	Understanding	CO 3									
2.	The joint probability function (X,Y) is given by $P(x, y) = k(2x + 3y)$, $x = 0, 1, 2; y = 1, 2, 3$, Find the value of K.	BTL-2	Understanding	CO 3									
3.	Find the probability distribution of X + Y from the bivariate distribution of (X,Y) given below: <table><tr><td>X \ Y</td><td>1</td><td>2</td></tr><tr><td>1</td><td>0.4</td><td>0.2</td></tr><tr><td>2</td><td>0.3</td><td>0.1</td></tr></table>	X \ Y	1	2	1	0.4	0.2	2	0.3	0.1	BTL-2	Understanding	CO 3
X \ Y	1	2											
1	0.4	0.2											
2	0.3	0.1											
4.	If the joint pdf of X and Y is given by $f(x,y)=2$, in $0 \leq x < y \leq 1$, Find E(X)	BTL-1	Remembering	CO 3									
5.	Find the marginal distributions of X and Y from the bivariate distribution of (X,Y) given below: <table><tr><td>X \ Y</td><td>1</td><td>2</td></tr><tr><td>1</td><td>0.1</td><td>0.2</td></tr><tr><td>2</td><td>0.3</td><td>0.4</td></tr></table>	X \ Y	1	2	1	0.1	0.2	2	0.3	0.4	BTL-2	Understanding	CO 3
X \ Y	1	2											
1	0.1	0.2											
2	0.3	0.4											
6.	Find the value of k, if the joint density function of (X,Y) as $f(x, y) = \begin{cases} k(1-x)(1-y), & 0 < x < 4, 1 < y < 5 \\ 0, & \text{otherwise} \end{cases}$	BTL-1	Remembering	CO 3									
7.	If the joint probability density function of a random variable X and Y is given by $f(x, y) = \begin{cases} \frac{x^3 y^3}{16}, & 0 < x < 2, 0 < y < 2 \\ 0, & \text{otherwise} \end{cases}$ Obtain the marginal density function of X.	BTL-1	Remembering	CO 3									

8.	The joint pdf of the random variable (X,Y) is given by $f(x,y) = Kxye^{-(x^2+y^2)}$, $x > 0, y > 0$ Find the value of K.	BTL-1	Remembering	CO 3
9.	The joint probability density function of a random variable (X,Y) is $f(x,y) = ke^{-(2x+3y)}$, $x \geq 0, y \geq 0$. Point out the value of k.	BTL-2	Understanding	CO 3
10.	If the joint pdf of (X, Y) is $f(x,y) = \begin{cases} \frac{1}{4}, & 0 < x, y < 2 \\ 0, & \text{otherwise} \end{cases}$. Find $P(X + Y \leq 1)$	BTL-1	Remembering	CO 3
11.	Let X and Y be random variables with joint density function $f(x,y) = \begin{cases} 4xy, & 0 < x < 1, 0 < y < 1 \\ 0, & \text{otherwise} \end{cases}$ formulate the value of E(XY)	BTL-2	Understanding	CO 3
12.	Let the joint density function of a random variable X and Y be given by $f(x,y) = 8xy$, $0 < y \leq x \leq 1$. Calculate the marginal probability function of X	BTL-1	Remembering	CO 3
13.	What is the condition for two random variables are independent?	BTL-2	Understanding	CO 3
14.	If the joint probability density function of X and Y is $f(x,y) = e^{-(x+y)}$, $x, y \geq 0$. Are X and Y independent	BTL-1	Remembering	CO 3
15.	State any two properties of correlation coefficient	BTL-2	Understanding	CO 3
16.	Write the angle between the regression lines	BTL-1	Remembering	CO 3
17.	The regression equations are $x + 6y = 14$ and $2x + 3y = 1$. Evaluate the correlation coefficient between X & Y .	BTL-1	Remembering	CO 3
18.	If $\bar{X} = 970$, $\bar{Y} = 18$, $\sigma_x = 38$, $\sigma_y = 2$ and $r = 0.6$, Find the line of regression of X on Y.	BTL-2	Understanding	CO 3
19.	In a partially destroyed laboratory, record of an analysis of correlation data, the following results only are legible; Variance of X = 9; Regression equations are $8X - 10Y + 66 = 0$ and $40X - 18Y = 214$. Find the mean values of X and Y?	BTL-1	Remembering	CO 3
20.	The regression equations are $3x + 2y = 26$ and $6x + y = 31$. Find the correlation coefficient.	BTL-2	Understanding	CO 3
21.	State the relationship between correlation coefficient and Regression coefficient.	BTL-1	Remembering	CO 3
22.	Prove that $-1 \leq r_{xy} \leq 1$	BTL-2	Understanding	CO 3
23.	The equations of two regression lines are $3x+2y=19$ and $3y+9x=46$. Obtain the mean of X and Y.	BTL-1	Remembering	CO 3
24.	The equations of two regression lines are $3x+2y=19$ and $3y+9x=46$. Derive the correlation coefficient between X and Y.	BTL-1	Remembering	CO 3

25.	State the equations of two regression lines.	BTL-2	Understanding	CO 3																												
PART –B																																
1.	From the following table for bivariate distribution of (X, Y). Find (i) $P(X \leq 1)$ (ii) $P(Y \leq 3)$ (iii) $P(X \leq 1, Y \leq 3)$ (iv) $P(X \leq 1 / Y \leq 3)$ (v) $P(Y \leq 3 / X \leq 1)$ (vi) $P(X + Y \leq 4)$ <table><tr><td>Y \ X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>0</td><td>0</td><td>0</td><td>$\frac{1}{32}$</td><td>$\frac{2}{32}$</td><td>$\frac{2}{32}$</td><td>$\frac{3}{32}$</td></tr><tr><td>1</td><td>$\frac{1}{16}$</td><td>$\frac{1}{16}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td></tr><tr><td>2</td><td>$\frac{1}{32}$</td><td>$\frac{1}{32}$</td><td>$\frac{1}{64}$</td><td>$\frac{1}{64}$</td><td>0</td><td>$\frac{2}{64}$</td></tr></table>	Y \ X	1	2	3	4	5	6	0	0	0	$\frac{1}{32}$	$\frac{2}{32}$	$\frac{2}{32}$	$\frac{3}{32}$	1	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	2	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{64}$	$\frac{1}{64}$	0	$\frac{2}{64}$	BTL-2	Understanding	CO 3
Y \ X	1	2	3	4	5	6																										
0	0	0	$\frac{1}{32}$	$\frac{2}{32}$	$\frac{2}{32}$	$\frac{3}{32}$																										
1	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$																										
2	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{64}$	$\frac{1}{64}$	0	$\frac{2}{64}$																										
2.(a)	The two dimensional random variable (X, Y) has the joint probability mass function $f(x, y) = \frac{x+2y}{27}, x = 0, 1, 2; y = 0, 1, 2$. Find the marginal distributions of X and Y. Also find the conditional distribution of Y given X = 1 also find the conditional distribution of X given Y = 1.	BTL-3	Applying	CO 3																												
2.(b)	The joint pdf a bivariate R.V(X, Y) is given by $f(x, y) = \begin{cases} Kxy & , 0 < x < 1, 0 < y < 1 \\ 0 & , \text{otherwise} \end{cases}$ (1) Find K. (2) Find $P(X+Y < 1)$. (3) Are X and Y independent R.V's.	BTL-3	Applying	CO 3																												
3.(a)	If the joint pdf of (X, Y) is given by $P(x, y) = K(2x+3y)$, $x=0, 1, 2, 3$, $y = 1, 2, 3$ Find all the marginal probability distribution. Also find the probability distribution of X+Y.	BTL-3	Applying	CO 3																												
3.(b)	The joint pdf of the RV (X,Y) is given by $f(x, y) = kxye^{-(x^2+y^2)}, x > 0, y > 0$. Find the value of k. Also prove that X and Y are independent	BTL-4	Analyzing	CO 3																												
4.	The following table represents the joint probability distribution of the discrete RV (X,Y). i) Find all the marginal distribution ii) Find the conditional distributions of X/Y=2 iii) Find the conditional distribution of Y/X=1. <table><tr><td>Y \ X</td><td>0</td><td>1</td><td>2</td></tr><tr><td>-1</td><td>1/15</td><td>2/15</td><td>1/15</td></tr></table>	Y \ X	0	1	2	-1	1/15	2/15	1/15	BTL-2	Understanding	CO 3																				
Y \ X	0	1	2																													
-1	1/15	2/15	1/15																													

	<table><tr><td>0</td><td>3/15</td><td>2/15</td><td>1/15</td></tr><tr><td></td><td>2/15</td><td>1/15</td><td>2/15</td></tr></table>	0	3/15	2/15	1/15		2/15	1/15	2/15											
0	3/15	2/15	1/15																	
	2/15	1/15	2/15																	
5.	Find the marginal distribution of X and Y and also $P(P(X \leq 1, Y \leq 1), P(X \leq 1), P(Y \leq 1)$. Check whether X and Y are independent. The joint probability mass function of X and Y is <table><tr><td>Y \ X</td><td>0</td><td>1</td><td>2</td></tr><tr><td>0</td><td>0.10</td><td>0.04</td><td>0.02</td></tr><tr><td>1</td><td>0.08</td><td>0.20</td><td>0.06</td></tr><tr><td>2</td><td>0.06</td><td>0.14</td><td>.30</td></tr></table>	Y \ X	0	1	2	0	0.10	0.04	0.02	1	0.08	0.20	0.06	2	0.06	0.14	.30	BTL-2	Understanding	CO 3
Y \ X	0	1	2																	
0	0.10	0.04	0.02																	
1	0.08	0.20	0.06																	
2	0.06	0.14	.30																	
6.	The joint pdf of two dimensional random variables (X,Y) is given by $f(x,y)=\begin{cases} 25e^{-5y}, 0 < x < 0.2, y > 0 \\ 0, otherwise \end{cases}$ Find the covariance of x and y.	BTL-4	Analyzing	CO 3																
7.	If the joint pdf of a two-dimensional RV(X,Y) is Given $(x,y) = \begin{cases} x^2 + \frac{xy}{3}; 0 < x < 1, 0 < y < 2 \\ 0, elsewhere \end{cases}$. Find (i) $P\left(X > \frac{1}{2}\right)$ (ii) $P(Y < \frac{1}{2}, X < \frac{1}{2})$ (iii) $P\left(Y < \frac{1}{2} / X < \frac{1}{2}\right)$	BTL-3	Applying	CO 3																
8.	The joint pdf of a two dimensional random variable (X, Y) is given by $f(x,y) = xy^2 + \frac{x^2}{8}, 0 \leq x \leq 2, 0 \leq y \leq 1.$ Compute (i) $P\left(X > 1 / Y < \frac{1}{2}\right)$ (ii) $P\left(Y < \frac{1}{2} / X > 1\right)$ (iii) $P(X + Y) \leq 1$.	BTL-3	Applying	CO 3																
9.	(b)The joint pdf of X and Y is given by $f(x,y)=\begin{cases} kx(x-y), 0 < x < 2, -x < y < x \\ 0, otherwise \end{cases}$ (i)Find K (ii) Find $f_x(x)$ and $f_y(y)$	BTL-3	Applying	CO 3																
10	Find the Coefficient of Correlation between industrial production and export using the following table <table><tr><td>Production (X)</td><td>14</td><td>17</td><td>23</td><td>21</td><td>25</td></tr><tr><td>Export (Y)</td><td>10</td><td>12</td><td>15</td><td>20</td><td>23</td></tr></table>	Production (X)	14	17	23	21	25	Export (Y)	10	12	15	20	23	BTL-3	Applying	CO 3				
Production (X)	14	17	23	21	25															
Export (Y)	10	12	15	20	23															
11.	Find the correlation coefficient for the following heights of fathers X,their sons Y and also find the equations of regression lines. Hence find the height of son when the height of father is 71 <table><tr><td>X</td><td>65</td><td>66</td><td>67</td><td>67</td><td>68</td><td>69</td><td>70</td><td>72</td></tr></table>	X	65	66	67	67	68	69	70	72	BTL-3	Applying	CO 3							
X	65	66	67	67	68	69	70	72												

	Y	67	68	65	68	72	72	69	71				
12.	Obtain the lines of regression										BTL-2	Understanding	CO 3
	X	50	55	50	60	65	65	65	60	60			
	Y	11	14	13	16	16	15	15	14	13			
13.	If $f(x,y) = \frac{6-x-y}{8}$, $0 \leq x \leq 2$, $2 \leq y \leq 4$ for a bivariate random variable (X,Y), Evaluate the correlation coefficient ρ .										BTL-3	Applying	CO 3
14.	Two random variables X and Y have the joint density function $f(x,y) = x + y$, $0 \leq x \leq 1$, $0 \leq y \leq 1$. Evaluate the Correlation coefficient between X and Y.										BTL-4	Analyzing	CO 3
15.	The two regression lines are $4x-5y+33=0$ and $20x-9y=107$. Find the mean of X and Y. Also find the correlation coefficient between them										BTL-4	Analyzing	CO 3
16.	If X and Y each follow an exponential distribution with parameter 1 and are independent, find the pdf of $U = X-Y$.										BTL-3	Applying	CO 3
17.	If X and Y independent Random Variables with pdf e^{-x} , $x \geq 0$ and e^{-y} , $y \geq 0$. Devise the density function of $U = \frac{X}{X+Y}$ and $V = X+Y$. Are they independent?										BTL-3	Applying	CO 3
18.	Two random variables X and Y have the following joint probability density function $f(x,y) = \begin{cases} x+y; & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0, & \text{otherwise} \end{cases}$. Find the probability density function of the random variable $U = XY$.										BTL-4	Analyzing	CO 3

UNIT – IV TESTING OF HYPOTHESIS

Sampling distributions – Type I and Type II errors – Small and Large samples - Tests based on Normal ,t and F distributions for testing of mean, variance and proportion.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
PART – A				
1.	Define Statistics	BTL-1	Remembering	CO 4
2.	Define Parameter.	BTL-2	Understanding	CO 4
3.	Explain null and alternate hypothesis.	BTL-1	Remembering	CO 4
4.	Mention the various steps involved in testing of hypothesis.	BTL-2	Understanding	CO 4

5.	What is the essential difference between confidence limits and tolerance limits?	BTL-1	Remembering	CO 4
6.	Define Standard Error.	BTL-2	Understanding	CO 4
7.	Define Type I and Type II error.	BTL-1	Remembering	CO 4
8.	What are the parameters and statistics in sampling.	BTL-2	Understanding	CO 4
9.	Define level of significance.	BTL-2	Understanding	CO 4
10.	What is the test statistic for single mean in small sample test.	BTL-2	Understanding	CO 4
11.	A random sample of 25 cups from a certain coffee dispensing machine yields a mean $\bar{x} = 6.9$ ounces per cup. Use 0.05 level of significance to test, on the average, the machine dispense $\mu = 7.0$ ounces against the null hypothesis that, on the average, the machine dispenses $\mu < 7.0$ ounces. Assume that the distribution of ounces per cup is normal, and that the variance is the known quantity $\sigma^2 = 0.01$ ounces	BTL-1	Remembering	CO 4
12.	Twenty people were attacked by a disease and only 18 were survived. The hypothesis is set in such a way that the survival rate is 85% if attacked by this disease. Will you reject the hypothesis that it is more at 5% level. ($Z_{0.05} = 1.645$).	BTL-2	Understanding	CO 4
13.	In a large city A, 20 percent of a random sample of 900 school boys had a slight physical defect. In another large city B, 18.5 percent of a random sample of 1600 school boys had some defect. Is the difference between the proportions significant?	BTL-2	Understanding	CO 4
14.	A standard sample of 200 tins of coconut oil gave an average weight of 4.95 kg with a standard deviation of 0.21 kg. Do we accept that the net weight is 5 kg per tin at 5% level of significance?	BTL-2	Understanding	CO 4
15.	Write down the formula of test statistic 't' to test the significance of difference between the population mean and sample mean.	BTL-2	Understanding	CO 4
16.	Write down the formula of test statistic 't' to test the significance of difference between two sample means.	BTL-1	Remembering	CO 4
17.	What are the applications of t-test?	BTL-1	Remembering	CO 4

18.	What is the assumption of t-test?							BTL-1	Remembering	CO 4		
19.	Write the application of ‘F’ test.							BTL-1	Remembering	CO 4		
20.	Define ‘F’ variate.							BTL-1	Remembering	CO 4		
21.	What are the properties of “F” test?							BTL-1	Remembering	CO 4		
22.	Define one tailed and two tailed test.							BTL-2	Understanding	CO 4		
23.	Define Critical region and Acceptance region.							BTL-2	Understanding	CO 4		
24.	Write the formula for difference of means in large sample tests.							BTL-2	Understanding	CO 4		
25.	Define sampling distribution							BTL-2	Understanding	CO 4		
PART –B												
1.	A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160cms. Can it be reasonably regarded that this sample is from a population of mean 165 cm and standard deviation 10 cm?							BTL-2	Understanding	CO 4		
2.	The heights of 10 males of a given locality are found to be 70, 67, 62, 68, 61, 68, 70, 64, 64, 66 inches. Is it reasonable to believe that the average height is greater than 64 inches?							BTL-2	Understanding	CO 4		
3.	Two samples of 6 and 7 items have the following values for a variable. Sample 1: 39 41 42 42 44 40 Sample 2 : 40 42 39 45 38 39 40 Do the sample variances differ significantly?							BTL-3	Applying	CO 4		
4.	Two independent samples of sizes 8 and 7 contained the following values.							BTL -4	Analyzing	CO 4		
	Sample I	19	17	15	21	16	18				16	
	Sample II	15	14	15	19	15	18				16	
Test if the two populations have the same mean.												
5.	Two independent samples of 8 and 7 items respectively had the following Values of the variable (weight in kgs.) Use 0.05 LOS to test							BTL-3	Applying	CO 4		
	Sample I	9	11	13	11	15	9				12	14
	Sample II	10	12	10	14	9	8				10	
Whether the variances of the two population’s sample are equal.												
6.	Two random samples gave the following results:							BTL -4	Analyzing	CO 4		
	Sample	Size	Sample mean	Sum of squares of deviation from the mean								

	<table><tr><td>1</td><td>10</td><td>15</td><td>90</td></tr><tr><td>2</td><td>12</td><td>14</td><td>108</td></tr></table> Analyze whether the samples have come from the same normal population	1	10	15	90	2	12	14	108																	
1	10	15	90																							
2	12	14	108																							
7.	The mean braking strength of the cables supplied by manufacture is 1800 with S.D 100. By a new technique in the manufacturing process it is claimed that the breaking strength of the cable has increased. To test this claim a sample of 50 cables is tested and is found that the mean braking strength is 1850. Can we support the claim at 1% level of significance	BTL-3	Applying	CO 4																						
8.	In a certain factory there are two independent processes manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 Ozs, with a standard deviation of 12 Ozs, while the corresponding figures in a sample of 400 items from the other process are 124 and 14. Is the difference between the two sample means significant?	BTL -4	Analyzing	CO 4																						
9.	Two independent samples of sizes 8 and 7 contained the following values. <table><tr><td>Sample I</td><td>17</td><td>27</td><td>18</td><td>25</td><td>27</td><td>29</td><td>13</td><td>17</td></tr><tr><td>Sample II</td><td>16</td><td>16</td><td>20</td><td>27</td><td>26</td><td>25</td><td>21</td><td></td></tr></table> Test if the two populations have the same variance	Sample I	17	27	18	25	27	29	13	17	Sample II	16	16	20	27	26	25	21		BTL-3	Applying	CO 4				
Sample I	17	27	18	25	27	29	13	17																		
Sample II	16	16	20	27	26	25	21																			
10.	A manufacturer of electric bulbs, by some process, find the standard deviation of the lamps to be 100 hrs. He wants to change the process if the new process results in even smaller variation in the life of lamps. In adopting the new process, a sample of 150 bulbs gave the standard deviation of 95 hrs. Is the manufacturer justified in changing the process.	BTL -4	Analyzing	CO 4																						
11.	The nicotine content in milligram of two samples of toboco where found to be as follows Sample 1 24 27 26 21 25 Sample 2 27 30 28 31 22 36 Can it be said that this samples where from normal population with the same mean.	BTL-3	Applying	CO 4																						
12.	A group of 10 rats fed on diet A and another group of 8 rats fed on diet B, Recorded the following increase the following increase in weight.(gm) <table><tr><td>Diet A</td><td>5</td><td>6</td><td>8</td><td>1</td><td>12</td><td>4</td><td>3</td><td>9</td><td>6</td><td>10</td></tr><tr><td>Diet B</td><td>2</td><td>3</td><td>6</td><td>8</td><td>10</td><td>1</td><td>2</td><td>8</td><td>-</td><td>-</td></tr></table> Find the variances are significantly different. (Use F-test)	Diet A	5	6	8	1	12	4	3	9	6	10	Diet B	2	3	6	8	10	1	2	8	-	-	BTL-4	Analyzing	CO 4
Diet A	5	6	8	1	12	4	3	9	6	10																
Diet B	2	3	6	8	10	1	2	8	-	-																

13.	Random samples drawn from two places gave the following data relating to the heights of male adults: <table><tr><td></td><td>Place A</td><td>Place B</td></tr><tr><td>Mean height (in inches)</td><td>68.50</td><td>65.50</td></tr><tr><td>S.D (in inches)</td><td>2.5</td><td>3.0</td></tr><tr><td>No. of adult males in sample</td><td>1200</td><td>1500</td></tr></table> Test at 5 % level, that the mean height is the same for adults in the two places.		Place A	Place B	Mean height (in inches)	68.50	65.50	S.D (in inches)	2.5	3.0	No. of adult males in sample	1200	1500	BTL-3	Applying	CO 4		
	Place A	Place B																
Mean height (in inches)	68.50	65.50																
S.D (in inches)	2.5	3.0																
No. of adult males in sample	1200	1500																
14.	Samples of two types of electric bulbs were tested for length of life and following data were obtained. <table><tr><td></td><td>Type I</td><td>Type II</td></tr><tr><td>Sample Size</td><td>8</td><td>7</td></tr><tr><td>Sample Mean</td><td>1234hrs</td><td>1036hrs</td></tr><tr><td>Sample S.D</td><td>36hrs</td><td>40hrs</td></tr></table> Analyze that, is the difference in the means sufficient to warrant that type I is superior to type II regarding the length of life?		Type I	Type II	Sample Size	8	7	Sample Mean	1234hrs	1036hrs	Sample S.D	36hrs	40hrs	BTL-3	Applying	CO 4		
	Type I	Type II																
Sample Size	8	7																
Sample Mean	1234hrs	1036hrs																
Sample S.D	36hrs	40hrs																
15.	Two random samples gave the following data. <table><tr><td>Sample</td><td>Size</td><td>Mean</td><td>Variance</td></tr><tr><td>1</td><td>8</td><td>9.6</td><td>1.2</td></tr><tr><td>2</td><td>11</td><td>16.5</td><td>2.5</td></tr></table> Can we conclude that the two samples have drawn from the same normal population?	Sample	Size	Mean	Variance	1	8	9.6	1.2	2	11	16.5	2.5	BTL -4	Analyzing	CO 4		
Sample	Size	Mean	Variance															
1	8	9.6	1.2															
2	11	16.5	2.5															
16.	The nicotine content in milligram of two samples of tobacco where found to be as follows, test the significant difference between means of the two samples. <table><tr><td>Sample I</td><td>21</td><td>24</td><td>25</td><td>26</td><td>27</td><td>-</td></tr><tr><td>Sample II</td><td>22</td><td>27</td><td>28</td><td>30</td><td>31</td><td>36</td></tr></table>	Sample I	21	24	25	26	27	-	Sample II	22	27	28	30	31	36	BTL-3	Applying	CO 4
Sample I	21	24	25	26	27	-												
Sample II	22	27	28	30	31	36												

17.	The marks obtained by a group of 9 regular course students and another group of 11 part time course students in a test are given below : <table><tr><td>Sample I</td><td>56</td><td>62</td><td>63</td><td>54</td><td>60</td><td>51</td><td>67</td><td>69</td><td>58</td><td></td><td></td></tr><tr><td>Sample II</td><td>62</td><td>70</td><td>71</td><td>62</td><td>60</td><td>56</td><td>75</td><td>64</td><td>72</td><td>68</td><td>66</td></tr></table> Examine whether the marks obtained by regular students and part-time students differ significantly at 5% levels of significance.	Sample I	56	62	63	54	60	51	67	69	58			Sample II	62	70	71	62	60	56	75	64	72	68	66	BTL-3	Applying	CO 4
Sample I	56	62	63	54	60	51	67	69	58																			
Sample II	62	70	71	62	60	56	75	64	72	68	66																	
18.	A simple sample of heights of 6400 Englishmen has a mean of 170cms and a standard deviation of 6.4cms, while a simple sample of heights of 1600 Americans has a mean of 172 cm and a standard deviation of 6.3cms. Do the data indicate that Americans are, on the average, taller than Englishmen?	BTL -4	Analyzing	CO 4																								

UNIT – V PARAMETRIC TESTS

Chi-square tests for independence of attributes and goodness of fit – Design of experiments, One way Classification, Two way Classification

Q.No.		Bloom's Taxonomy Level	Competence	Course Outcome				
PART – A								
1.	Write the formula for the chi- square test of goodness of fit of a random sample to a hypothetical distribution.	BTL-2	Understanding	CO 5				
2.	State the main use of ψ^2 -test	BTL-1	Remembering	CO 5				
3.	What are the expected frequencies of 2x2 contingency table? <table border="1"><tr><td>a</td><td>b</td></tr><tr><td>c</td><td>d</td></tr></table>	a	b	c	d	BTL-2	Understanding	CO 5
a	b							
c	d							
4.	State any two applications of ψ^2 -test.	BTL-1	Remembering	CO 5				
5.	What is the aim of design of experiments?	BTL-2	Understanding	CO 5				
6.	Write the basic assumptions in analysis of variance.	BTL-1	Remembering	CO 5				
7.	When do you apply analysis of variance technique?	BTL-2	Understanding	CO 5				
8.	Define Replication.	BTL-1	Remembering	CO 5				
9.	Define Randomization.	BTL-2	Understanding	CO 5				
10.	Define Local control.	BTL-1	Remembering	CO 5				
11.	What is meant by tolerance limits?	BTL-2	Understanding	CO 5				

12.	What is a completely randomized design?	BTL-1	Remembering	CO 5
13.	What is ANOVA?	BTL-2	Understanding	CO 5
14.	What are the uses of ANOVA?	BTL-1	Remembering	CO 5
15.	Define experimental error.	BTL-2	Understanding	CO 5
16.	Write any two advantages of RBD over CRD.	BTL-1	Remembering	CO 5
17.	Write down the ANOVA table for Latin Square Design.	BTL-2	Understanding	CO 5
18.	Define one-way classification and two way classifications in ANOVA	BTL-1	Remembering	CO 5
19.	What are the basic elements of a Completely Randomized Experimental Design?	BTL-2	Understanding	CO 5
20.	Demonstrate the purpose of blocking in a randomized block design?	BTL-1	Remembering	CO 5
21.	Manipulate the Basic principles of the design of experiment?	BTL-2	Understanding	CO 5
22.	Write down the ANOVA table for One way classification	BTL-1	Remembering	CO 5
23.	Write down the ANOVA table for Randomized Block Design	BTL-2	Understanding	CO 5
24.	Write down the formula for mean sum of squares in one way classification	BTL-1	Remembering	CO 5
25.	Write down the formula for errors in two way classification.	BTL-2	Understanding	CO 5

PART –B

1.	Given the following table for hair color and eye color, identify the value of Chi-square. Is there good association between hair color and eye color? <table><tr><th colspan="6">Hair color</th></tr><tr><th rowspan="5">Eye color</th><th></th><th>Fair</th><th>Brown</th><th>Black</th><th>Total</th></tr><tr><th>Blue</th><td>15</td><td>5</td><td>20</td><td>40</td></tr><tr><th>Grey</th><td>20</td><td>10</td><td>20</td><td>50</td></tr><tr><th>Brown</th><td>25</td><td>15</td><td>20</td><td>60</td></tr><tr><th>Total</th><td>60</td><td>30</td><td>60</td><td>150</td></tr></table>	Hair color						Eye color		Fair	Brown	Black	Total	Blue	15	5	20	40	Grey	20	10	20	50	Brown	25	15	20	60	Total	60	30	60	150	BTL -3	Applying	CO 5
Hair color																																				
Eye color		Fair	Brown	Black	Total																															
	Blue	15	5	20	40																															
	Grey	20	10	20	50																															
	Brown	25	15	20	60																															
	Total	60	30	60	150																															
2.	Test of fidelity and selectivity of 190 radio receivers produced the results shown in the following table <table><tr><th colspan="4">Fidelity</th></tr><tr><th>Selectivity</th><th>Low</th><th>Average</th><th>High</th></tr><tr><th>Low</th><td>6</td><td>12</td><td>32</td></tr><tr><th>Average</th><td>33</td><td>61</td><td>18</td></tr><tr><th>High</th><td>13</td><td>15</td><td>0</td></tr></table> Use 0.01 level of significance to test whether there is a relationship between fidelity and selectivity	Fidelity				Selectivity	Low	Average	High	Low	6	12	32	Average	33	61	18	High	13	15	0	BTL -3	Applying	CO 5												
Fidelity																																				
Selectivity	Low	Average	High																																	
Low	6	12	32																																	
Average	33	61	18																																	
High	13	15	0																																	
3.	Records taken of the number of male and female births in 800 families having four Children are as follows :	BTL -4	Analyzing	CO 5																																

	Number of male births : 0 1 2 3 4 Number of female births : 4 3 2 1 0 Number of Families : 32 178 290 236 64 Infer whether the data are consistent with the hypothesis that the binomial law holds the chance of a male birth is equal to female birth, namely $p = \frac{1}{2} = q$.																								
4.	A survey of 320 families with 5 children each revealed the following distribution <table border="1"><tr><td>Boys</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>Girls</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Families</td><td>14</td><td>56</td><td>110</td><td>88</td><td>40</td><td>12</td></tr></table> Is this result consistent with the hypothesis that male and female births are equally probable?	Boys	5	4	3	2	1	0	Girls	0	1	2	3	4	5	Families	14	56	110	88	40	12	BTL -3	Applying	CO 5
Boys	5	4	3	2	1	0																			
Girls	0	1	2	3	4	5																			
Families	14	56	110	88	40	12																			
5.	Mechanical engineers testing a new arc welding technique, classified welds both with respect to appearance and an X-ray inspection <table border="1"><tr><td>X-ray/Appearance</td><td>Bad</td><td>Normal</td><td>Good</td></tr><tr><td>Bad</td><td>20</td><td>7</td><td>3</td></tr><tr><td>Normal</td><td>13</td><td>51</td><td>16</td></tr><tr><td>Good</td><td>7</td><td>12</td><td>21</td></tr></table> Test for independence using 0.05 level of significance.	X-ray/Appearance	Bad	Normal	Good	Bad	20	7	3	Normal	13	51	16	Good	7	12	21	BTL -3	Applying	CO 5					
X-ray/Appearance	Bad	Normal	Good																						
Bad	20	7	3																						
Normal	13	51	16																						
Good	7	12	21																						
6.	A sample of 200 persons with a particular disease was selected. Out of these, 100 were given a drug and the others were not given any drug. The result are as follows: <table border="1"><tr><td>Number of persons</td><td>Drug</td><td>No drug</td><td>Total</td></tr><tr><td>Cured</td><td>65</td><td>55</td><td>120</td></tr><tr><td>Not cured</td><td>35</td><td>45</td><td>80</td></tr><tr><td>Total</td><td>100</td><td>100</td><td>200</td></tr></table> Test whether the drug is effective or not?	Number of persons	Drug	No drug	Total	Cured	65	55	120	Not cured	35	45	80	Total	100	100	200	BTL -4	Analyzing	CO 5					
Number of persons	Drug	No drug	Total																						
Cured	65	55	120																						
Not cured	35	45	80																						
Total	100	100	200																						
7.	The following data gives the number of aircraft accidents that occurred during the various days of a week. Find whether the accidents are uniformly distributed over the week <table border="1"><tr><td>Days</td><td>Sun</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr><tr><td>No.of accidents</td><td>14</td><td>16</td><td>08</td><td>12</td><td>11</td><td>9</td><td>14</td></tr></table>	Days	Sun	Mon	Tue	Wed	Thu	Fri	Sat	No.of accidents	14	16	08	12	11	9	14	BTL -4	Analyzing	CO 5					
Days	Sun	Mon	Tue	Wed	Thu	Fri	Sat																		
No.of accidents	14	16	08	12	11	9	14																		
8.	The theory predicts that the population of beans in the four groups A, B, C and D should be 9:3:3:1. In an experiment among 1600 beans, the number in the four groups was 882,313,287 and 118. Do the experimental results support the survey?	BTL -3	Applying	CO 5																					

9.	5 coins were tossed 320 times. The number of heads observed is given below : <table><tr><td>No. of heads</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Observed frequencies</td><td>15</td><td>45</td><td>85</td><td>95</td><td>60</td><td>20</td></tr></table> Examine whether the coin is unbiased .Use 5% level of significance.	No. of heads	0	1	2	3	4	5	Observed frequencies	15	45	85	95	60	20	BTL4	Analyzing	CO 5										
No. of heads	0	1	2	3	4	5																						
Observed frequencies	15	45	85	95	60	20																						
10.	The accompanying data resulted from an experiment comparing the degree of soiling for fabric copolymerized with the 3 different mixtures of met acrylic acid. Analyze the classification. Mixture 1 : 0.56 1.12 0.90 1.07 0.94 Mixture 2 : 0.72 0.69 0.87 0.78 0.91 Mixture 3 : 0.62 1.08 1.07 0.99 0.93	BTL -4	Analyzing	CO 5																								
11.	A set of data involving 4 tropical food stuffs A, B, C, D tried on 20 chicks is given below. All the 20 chicks are treated alike in all respects except the feeding treatments and each feeding treatment is given to 5 chicks. Analyze the data: <table><tr><td>A</td><td>55</td><td>49</td><td>42</td><td>21</td><td>52</td></tr><tr><td>B</td><td>61</td><td>112</td><td>30</td><td>89</td><td>63</td></tr><tr><td>C</td><td>42</td><td>97</td><td>81</td><td>95</td><td>92</td></tr><tr><td>D</td><td>169</td><td>137</td><td>169</td><td>85</td><td>154</td></tr></table>	A	55	49	42	21	52	B	61	112	30	89	63	C	42	97	81	95	92	D	169	137	169	85	154	BTL -4	Analyzing	CO 5
A	55	49	42	21	52																							
B	61	112	30	89	63																							
C	42	97	81	95	92																							
D	169	137	169	85	154																							
12.	In order to determine whether the significant difference in the durability of 3makes of computers, samples of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as follows: In view of the above data, what conclusion can you draw? Makes <table><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>5</td><td>8</td><td>7</td></tr><tr><td>6</td><td>10</td><td>3</td></tr><tr><td>8</td><td>11</td><td>5</td></tr><tr><td>9</td><td>12</td><td>4</td></tr><tr><td>7</td><td>4</td><td>1</td></tr></table>	A	B	C	5	8	7	6	10	3	8	11	5	9	12	4	7	4	1	BTL -3	Applying	CO 5						
A	B	C																										
5	8	7																										
6	10	3																										
8	11	5																										
9	12	4																										
7	4	1																										

13.	A random sample is selected from each of 3 makes of ropes and their braking strength are measured with the following results. I : 70 72 75 80 83 II : 100 110 108 112 113 120 107 III : 60 65 57 84 87 73 Test whether the braking strength of the ropes differs significantly?	BTL -3	Applying	CO 5																																										
14.	The following are the number of mistakes made in 5 successive days by four technicians working for a photographic laboratory. Test whether the difference among the four sample means can be attributed to chance. Test at a level of significance $\alpha = 0.01$. <table><tr><th colspan="4">Technician</th></tr><tr><th>I</th><th>II</th><th>III</th><th>IV</th></tr><tr><td>6</td><td>14</td><td>10</td><td>9</td></tr><tr><td>14</td><td>9</td><td>12</td><td>12</td></tr><tr><td>10</td><td>12</td><td>7</td><td>8</td></tr><tr><td>8</td><td>10</td><td>15</td><td>10</td></tr><tr><td>11</td><td>14</td><td>11</td><td>11</td></tr></table>	Technician				I	II	III	IV	6	14	10	9	14	9	12	12	10	12	7	8	8	10	15	10	11	14	11	11	BTL -4	Analyzing	CO 5														
Technician																																														
I	II	III	IV																																											
6	14	10	9																																											
14	9	12	12																																											
10	12	7	8																																											
8	10	15	10																																											
11	14	11	11																																											
15.	Five doctors each test five treatments for a certain disease and observe the number of days each patient takes to recover. The results are as follows (recovery time in days) <table><tr><th></th><th colspan="5">Treatment</th></tr><tr><th>Doctor</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><td>A</td><td>10</td><td>14</td><td>23</td><td>18</td><td>20</td></tr><tr><td>B</td><td>11</td><td>15</td><td>24</td><td>17</td><td>21</td></tr><tr><td>C</td><td>9</td><td>12</td><td>20</td><td>16</td><td>19</td></tr><tr><td>D</td><td>8</td><td>13</td><td>17</td><td>17</td><td>20</td></tr><tr><td>E</td><td>12</td><td>15</td><td>19</td><td>15</td><td>22</td></tr></table> Estimate the difference between (a) doctors and (b) treatments for the above data at 5% level.		Treatment					Doctor	1	2	3	4	5	A	10	14	23	18	20	B	11	15	24	17	21	C	9	12	20	16	19	D	8	13	17	17	20	E	12	15	19	15	22	BTL -3	Applying	CO 5
	Treatment																																													
Doctor	1	2	3	4	5																																									
A	10	14	23	18	20																																									
B	11	15	24	17	21																																									
C	9	12	20	16	19																																									
D	8	13	17	17	20																																									
E	12	15	19	15	22																																									
16.	Perform a 2-way ANOVA on the data given below: <table><tr><th colspan="2" rowspan="2"></th><th colspan="3">Treatment 1</th></tr><tr><th>1</th><th>2</th><th>3</th></tr><tr><td rowspan="3">Treatment 2</td><td>1</td><td>30</td><td>26</td><td>38</td></tr><tr><td>2</td><td>24</td><td>29</td><td>28</td></tr><tr><td>3</td><td>33</td><td>24</td><td>35</td></tr></table>			Treatment 1			1	2	3	Treatment 2	1	30	26	38	2	24	29	28	3	33	24	35	BTL -3	Applying	CO 5																					
				Treatment 1																																										
		1	2	3																																										
Treatment 2	1	30	26	38																																										
	2	24	29	28																																										
	3	33	24	35																																										

		4	36	31	30						
		5	27	35	33						
	Apply the coding method subtracting 30 from the given no.										
17.	The following data represents the number of units of production per day turned out by different workers using 4 different types of machines					BTL -3	Applying	CO 5			
		Machine Type									
	Work ers		A	B	C				D		
		1	44	38	47				36		
		2	46	40	52				43		
		3	34	36	44				32		
		4	43	38	46				33		
	5	38	42	49	39						
	Test whether the mean productivity is the same for the 4 different machines types and 5 different workers?										
18.	Four different though supposedly equivalent forms of a standardized reading achievement test were given to each of 5 students and the following are the scores, which they obtained					BTL -3	Applying	CO 5			
			Student								
			1	2	3				4	5	
	Form	A	75	73	59				69	84	
		B	83	72	56				70	92	
		C	86	61	53				72	88	
		D	73	67	62				79	95	
	Perform a two way analysis of variance to test at the level of significance 1%.										