

SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203.

(An Autonomous Institution)

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
&
DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

QUESTION BANK



I SEMESTER

**MA3123 – ADVANCED MATHEMATICS FOR ELECTRICAL AND INSTRUMENTATION
ENGINEERING**

Regulation – 2023

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Prepared by

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SRM VALLIAMMAI ENGINEERING COLLEGE



DEPARTMENT OF MATHEMATICS

QUESTION BANK

SUBJECT : MA3123 – ADVANCED MATHEMATICS FOR ELECTRICAL AND INSTRUMENTATION ENGINEERING

SEM / YEAR : I / I year M.E. (PSE & CI)

UNIT I -MATRIX THEORY- Cholesky decomposition - Generalized Eigen vectors, Canonical basis - QR factorization - Singular value decomposition -Least squares method.				
Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
PART – A				
1.	Define Real Symmetric Matrix.	BTL -1	Remembering	CO 1
2.	Define Hermitian Matrix.	BTL -1	Remembering	CO 1
3.	Write the necessary conditions for Cholesky decomposition of a matrix	BTL -2	Understanding	CO 1
4.	Write down the uses of Cholesky decomposition method.	BTL -2	Understanding	CO 1
5.	Find the Cholesky decomposition of $\begin{pmatrix} 4 & 3 \\ 3 & 5 \end{pmatrix}$	BTL -2	Understanding	CO 1
6.	Find the Cholesky decomposition of $\begin{pmatrix} 4 & 2 \\ 2 & 10 \end{pmatrix}$	BTL -2	Understanding	
7.	Define orthogonal and orthonormal vectors	BTL -2	Understanding	CO 1
8.	Verify if the matrix $Q = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ is orthogonal	BTL -1	Remembering	CO 1
9.	Explain the Gram-Schmidt orthonormal process	BTL -1	Remembering	CO 1
10.	Determine the canonical basis for $A = \begin{bmatrix} 3 & 5 \\ -2 & -4 \end{bmatrix}$.	BTL -1	Remembering	CO 1
11.	Define QR decomposition	BTL -4	Analyzing	CO 1
12.	If A is a nonsingular matrix, then what is A^+ ?	BTL -1	Remembering	CO 1
13.	Define singular matrix with an example.	BTL -1	Remembering	CO 1
14.	What is the advantage in matrix factorization methods?	BTL -1	Remembering	CO 1

15.	State Singular value decomposition theorem	BTL -1	Remembering	CO 1
16.	Write short note on Singular value decomposition of complex matrix A.	BTL -1	Remembering	CO 1
17.	Find the sum and product of the Eigen values of the matrix $\begin{pmatrix} 2 & 2 & 0 \\ 2 & 2 & 1 \\ -7 & 2 & -3 \end{pmatrix}$	BTL -2	Understanding	CO 1
18.	Check whether the given matrix is positive definite or not $\begin{pmatrix} 3 & 1 & -1 \\ 1 & 3 & -1 \\ -1 & -1 & 5 \end{pmatrix}$	BTL -2	Understanding	CO 1
19.	Define the generalized Eigen vector, chain of rank m, for a square matrix.	BTL -1	Remembering	CO 1
20.	Define Least square method.	BTL -1	Remembering	CO 1
21.	If the sum of two eigenvalues and trace of a 3x3 matrix A are equal find the value of A .	BTL -2	Understanding	CO 1
22.	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
23.	Find the least squares solution to the system: $x = 2, 2x = 3$	BTL -2	Understanding	CO 1
24.	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
25.	Find the generalized inverse of $\begin{pmatrix} 1 & 1 \\ 0 & 1 \\ 1 & 0 \end{pmatrix}$	BTL -2	Understanding	CO 1
PART - B				
1.	Determine the Cholesky decomposition of the matrix $\begin{bmatrix} 4 & 2i & -i \\ -2i & 10 & 1 \\ i & 1 & 9 \end{bmatrix}$	BTL -3	Applying	CO 1
2.	Obtain the Cholesky decomposition of the matrix $\begin{bmatrix} 4 & 2i & 2 \\ -2i & 10 & 1-i \\ 2 & 1+i & 9 \end{bmatrix}$	BTL -3	Applying	CO 1
3.	Determine the Cholesky decomposition of $\begin{bmatrix} 9 & -3 & 0 & -3 \\ -3 & 6 & 3 & 0 \\ 0 & 6 & 3 & 0 \\ -3 & 0 & -3 & 6 \end{bmatrix}$	BTL -3	Applying	CO 1
4.	Determine the Cholesky decomposition of the matrix $\begin{bmatrix} 16 & -3 & 5 & -8 \\ -3 & 16 & -5 & -8 \\ 5 & -5 & 24 & 0 \\ 8 & -8 & 0 & 21 \end{bmatrix}$	BTL -3	Applying	CO 1
5.	Analyze the QR factorization of $A = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$	BTL -4	Analysing	CO 1

6.	Analyse the QR factorization of $A = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 0 & 0 \\ 1 & 0 & -2 \\ 1 & 1 & 1 \end{bmatrix}$	BTL -4	Analysing	CO 1
7.	Obtain the QR factorization of $A = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$	BTL -3	Applying	CO 1
8.	Obtain the singular value decomposition of $A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \\ 1 & 3 \end{bmatrix}$	BTL -3	Applying	CO 1
9.	Construct the singular value decomposition for $\begin{bmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & -2 & 6 \end{bmatrix}$	BTL -4	Analyzing	CO 1
10.	Obtain the singular value decomposition of $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & 3 \end{bmatrix}$	BTL -3	Applying	CO 1
11.	Obtain the singular value decomposition of $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 1 & 3 \end{bmatrix}$	BTL -3	Applying	CO 1
12.	Solve the following system of equations in the least square sense $x_1 + x_2 + 3x_3 = 1$; $x_1 + x_2 + 3x_3 = 2$	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.	Solve the following system of equations in the least square sense $x_1 + x_2 + x_3 = 2$; $x_1 + x_2 + x_3 = 4$; $x_1 + x_2 + x_3 = 6$.	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-CALCULUS OF VARIATION: Concept of variation and its properties–Euler’s equation–Functional dependent on first and higher order derivatives–Functional dependent on functions of several independent variables–Variational problems with moving boundaries–Isoperimetric problems–Direct methods: Ritz and Kantorovich methods.

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

1.	Define a functional	BTL -1	Remembering	CO 2
2.	Write Euler's equation for functional.	BTL -1	Remembering	CO 2
3.	Write Euler-Poisson equation.	BTL -1	Remembering	CO 2
4.	Find the extremals of the functional $\int (y^2 - y'^2 - 2y \sin x) dx$.	BTL -3	Applying	CO 2
5.	Test for an extremum the functional Find the extremals of $\int_{x_0}^{x_1} (y^2 + y'^2 - 2ye^x) dx$	BTL -1	Remembering	CO 2
6.	Prove that the commutative character for the operators of variation and differentiation.	BTL -2	Understanding	CO 2
7.	Show that the symbols $\frac{d}{dx}$ and δ are commutative.	BTL -3	Applying	CO 2
8.	State Brachistochrone problem.	BTL -2	Understanding	CO 2
9.	Find the curves on which the functional $\int_0^1 (y'^2 + 12xy) dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremised.	BTL -2	Understanding	CO 2
10.	Write the ostrogradsky equation for the functional $I[z(x,y)] = \iint_D \left\{ \left(\frac{\partial z}{\partial x} \right)^2 + \left(\frac{\partial z}{\partial y} \right)^2 + zf(x,y) \right\} dx dy$	BTL -2	Understanding	CO 2
11.	Write the ostrogradsky equation for the functional $\iint_D \left(\left[\frac{\partial z}{\partial x} \right]^2 + \left[\frac{\partial z}{\partial y} \right]^2 \right) dx dy$	BTL -2	Understanding	CO 2
12.	Define isoperimetric problems.	BTL -1	Remembering	CO 2
13.	Define moving boundaries.	BTL -2	Understanding	CO 2
14.	Find the transversality condition for the functional $v = \int_{x_0}^{x_1} A(x,y) \cdot \sqrt{1 + \left(\frac{dy}{dx} \right)^2} dx$ with the right boundary moving along $y_1 = \varphi(x_1)$	BTL -1	Remembering	CO 2
15.	What is the differential equation the functional $I[y(x)] = \int_0^1 (xy + y'^2 - 2y^2 y') dx$ $y(0)=1, y(1)=2$.	BTL -2	Understanding	CO 2
16.	Write down biharmonic equation.	BTL -2	Understanding	CO 2
17.	State Hamilton's Principle	BTL -2	Understanding	CO 2
18.	Find the fundamental lemma of calculus of variation.	BTL -1	Remembering	CO 2
19.	Explain direct methods in variational problem	BTL -2	Understanding	CO 2
20.	Explain Rayleigh-Ritz method.	BTL -2	Understanding	CO 2
21.	Find the Euler equation of the functional $\int_0^{\pi/2} \left(y^2 - \left(\frac{dy}{dx} \right)^2 - 2y \sin x \right) dx$	BTL -1	Remembering	CO 2

22.	Determine the differential equation of the functional $\int_0^{\pi} (y'^2 - y^2 + 4y \cos x) dx$	BTL -2	Understanding	CO 2
23.	What is the shortest distance between two points in a plane	BTL -1	Remembering	CO 2
24.	Find extremal of the functional $I(y(x)) = \int_0^1 (1 + y'^2) dx$	BTL -2	Understanding	CO 2
25.	The transversality condition for the functional $w = \int_{x_0}^{x_1} G(x, y) \cdot \sqrt{1 + (y')^2} dx$ with the right boundary moving along $y_1 = f(x_1)$	BTL -2	Understanding	CO 2
PART -B				
1.	$I[y(x)] = \int_0^1 (xy + y^2 - 2y^2 y') dx$, $y(0) = 1$, $y(1) = 2$.	BTL4	Analyzing	CO 2
2.	Find the extremal of the function $v[y(x), z(x)] \int_{x_0}^x [2yz - 2y^2 + y'^2 - z'^2] dx$.	BTL3	Applying	CO 2
3.	Show that the straight line is the sharpest distance between two points in a plane.	BTL4	Analyzing	CO 2
4.	Show that the curve which extremize $I = \int_0^{\frac{\pi}{2}} [(y^{11})^2 - y^2 + x^2] dx$ given that $y(0) = 0, y^1(0) = 1, y(\frac{\pi}{4}) = \frac{1}{\sqrt{2}}, y^1(\frac{\pi}{4}) = \frac{1}{\sqrt{2}}$ is $y = \sin x$.	BTL4	Analyzing	CO 2
5.	Find the shortest distance between the point (-1,5) and the parabola $y^2 = x$	BTL4	Analyzing	CO 2
6.	Find the extremals of the functional $\int_0^1 (1 + y'^2) dx$. Subject to $y(0) = 0$, $y'(0) = 1$, $y(1) = 1$, $y'(1) = 1$.	BTL3	Applying	CO 2
7.	Find the extremal of the functional $\int_0^{\pi} (y'^2 - y^2 + 4y \cos x) dx$. $y(0) = 0$, $y(\pi) = 0$.	BTL3	Applying	CO 2
8.	Solve the boundary value problem $y^{11} - y + x = 0$ ($0 \leq x \leq 1$) $y(0) = y(1) = 0$ by Rayleigh Ritz method.	BTL3	Applying	CO 2
9.	To determine the shape of a solid of revolution moving in a flow of gas with least resistance.	BTL4	Analyzing	CO 2
10.	Derive the Euler's equation and use it, find the extremals of the functional $V[y(x)] = \int_{x_0}^{x_1} (y^2 + y'^2 - 2y \sin x) dx$.	BTL3	Applying	CO 2

11.	Find an approximate solution to the problem of the minimum, of the functional $J(y) = \int_0^1 (y'^2 - y^2 + 2xy) dx$. $y(0)=0=y(1)$ by Ritz method and compare it with the exact solution.	BTL3	Applying	CO 2
12.	Find the solid of maximum volume formed by the revolution of a given surface area.	BTL4	Analyzing	CO 2
13.	Find the extremals of the functional $\int_0^{\pi/2} (y'^2 + z'^2 + 2yz) dx$. Given that $y(0) = 0$, $y(\pi/2) = -1$, $z(0) = 0$, $z(\pi/2) = 1$	BTL3	Applying	CO 2
14.	Find the curve connect in the points A and B which is traversed by a particle sliding from A to B in the shortest time.	BTL4	Analyzing	CO 2
15.	Discuss the Branchistochrone Problem.	BTL3	Applying	CO 2
16.	Prove that the sphere is the solid figure of revolution which for a given surface area has maximum volume.	BTL4	Analyzing	CO 2
17.	Find the plane curve of a fixed perimeter and maximum area.	BTL3	Applying	CO 2
18.	Find the extremal of the functional $I(y, z) = \int_0^1 (y'^2 + z'^2 + 2yz) dx$; $y(0)=1$, $y(1)=\frac{3}{2}$, $z(0)=0$, $z(1)=1$	BTL4	Analyzing	CO 2

UNIT – III PROBABILITY AND RANDOM VARIABLES: Probability–Axioms of probability–Conditional probability–Baye’s theorem–Random variables–Probability function–Moments–Moment generating functions and their properties–Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions–Function of a random variable.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome							
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 3							
	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 3							
	No.of failures				0	1	2	3	4	5	6
	Probability				K	2 K	2 K	K	3 K	K	4
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	BTL-2	Understanding	CO 3							

	discrete random variable.													
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 3										
5.	The RV X has the following probability distribution: <table border="1"> <tr> <td>x</td><td>-2</td><td>-1</td><td>0</td><td>1</td></tr> <tr> <td>P(x)</td><td>0.4</td><td>k</td><td>0.2</td><td>0.3</td></tr> </table> Find k and the mean value of X	x	-2	-1	0	1	P(x)	0.4	k	0.2	0.3	BTL-2	Understanding	CO 3
x	-2	-1	0	1										
P(x)	0.4	k	0.2	0.3										
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 3										
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 3										
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 3										
9.	If $f(x) = kx^2$, $0 < x < 3$, is to be a density function, find the value of k.	BTL-2	Understanding	CO 3										
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 3										
11.	The mean of Binomial distribution is 20 and standard deviation is 4. Find the parameters of the distribution.	BTL3	Applying	CO 3										
12.	The mean and variance of binomial distribution are 5 and 4. Determine the distribution.	BTL4	Analyzing	CO 3										
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.	BTL4	Analyzing	CO 3										
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.	BTL3	Applying	CO 3										
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.	BTL4	Analyzing	CO 3										
16.	If X is a Poisson variate such that $2P(X = 0) + P(X = 2) = 2P(X = 1)$, find E(X)	BTL4	Analyzing	CO 3										
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?	BTL4	Analyzing	CO 3										
18.	If $f(x) = \frac{x^2}{3}$, $-1 < x < 2$ is the pdf of the random variable X, then find $p(0 < x < 1)$	BTL3	Applying	CO 3										
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	BTL4	Analyzing	CO 3										

	the probability that he will finally pass the test on the fourth trial																					
20.	If X has uniform distribution in (-3,3), find $P(x - 2 < 2)$	BTL-2	Understanding	CO 3																		
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.	BTL4	Analyzing	CO 3																		
22.	A Random variable X is uniformly distributed between 3 and 15. Find the variance of X.	BTL5	Evaluating	CO 3																		
23.	A continuous RV X has the density function $ce^{-\frac{x}{5}}, x > 0$. Find c. Create E(x) and Var(X)	BTL6	Creating	CO 3																		
24.	If X is a normal random variable with mean 3 and variance 9, find the probability that X lies between 2 and 5.	BTL3	Applying	CO 3																		
25.	A normal distribution has mean $\mu = 20$ and standard deviation $\sigma = 10$. Evaluate $(15 \leq X \leq 40)$.	BTL5	Evaluating	CO 3																		
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></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></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	P(X)	0	k	2 k	2 k	3 k	k ²	2k ²	BTL-2	Understanding	CO 3		
X	0	1	2	3	4	5	6															
P(X)	0	k	2 k	2 k	3 k	k ²	2k ²															
1. (b)	Find the MGF of Binomial distribution and hence find its mean and variance	BTL-1	Remembering	CO 3																		
2.(a)	The probability mass function of a discrete R. V X is given in the following table:<table><tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</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></tr></table> Find (1) Find the value of k, (2) $P(X < 1)$, (3) $P(-1 < X \leq 2)$	X	-2	-1	0	1	2	P(X=x)	0.1	K	0.2	2k	0.3	BTL-2	Understanding	CO 3						
X	-2	-1	0	1	2																	
P(X=x)	0.1	K	0.2	2k	0.3																	
2.(b)	Obtain the MGF of Poisson distribution and hence find its mean and variance	BTL-1	Remembering	CO 3																		
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></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></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	P(X)	a	3a	5a	7a	9a	11a	13a	15a	BTL-2	Understanding	CO 3
X	0	1	2	3	4	5	6	7														
P(X)	a	3a	5a	7a	9a	11a	13a	15a														
3.(b)	Deduce the MGF of a geometric distribution and hence find the mean and variance	BTL-1	Remembering	CO 3																		
4.(a)	If the discrete random variable X has the probability function given by the table.	BTL-2	Understanding	CO 3																		

	<table border="1"> <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	$P(x)$	$k/3$	$k/6$	$k/3$	$k/6$			
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-1	Remembering	CO 3										
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.	BTL3	Applying	CO 3										
5.(b)	Deduce the MGF of Exponential distribution and hence find its mean and variance	BTL-1	Remembering	CO 3										
6. (a)	Find the MGF , mean and variance of the random variable X has the pdf $f(x) = \begin{cases} x, 0 < x < 1 \\ 2-x, 1 < x < 2 \\ 0, \text{otherwise} \end{cases}$	BTL-2	Understanding	CO 3										
6.(b)	State and prove the memory less property of exponential distribution	BTL3	Applying	CO 3										
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 3										
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.	BTL3	Applying	CO 3										
8.	Deduce the MGF of a normal distribution and hence apply it to derive its mean and variance	BTL3	Applying	BTL3										
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-2	Understanding	CO 3										
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.	BTL3	Applying	CO 3										
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-2	Understanding	CO 3										
10.(b)	4 coins were tossed simultaneously. What is the probability of getting	BTL4	Analyzing	CO 3										

	(i) 2 heads, (ii) at least 2 heads, (iii) at most 2 heads.			
11.(a)	A random variable X has $\text{c.d.f } F(x) = \begin{cases} 0, & \text{if } x < -1 \\ a(1+x), & \text{if } -1 < x < 1 \\ 1, & \text{if } x \geq 1 \end{cases}$ Find the value of a. Also $P(X > 1/4)$ and $P(-0.5 \leq X \leq 0)$.	BTL-2	Understanding	CO 3
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	BTL4	Analyzing	CO 3
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-2	Understanding	CO 3
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-2	Understanding	CO 3
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.	BTL3	Applying	CO 3
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	BTL3	Applying	CO 3
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 3
15.(a)	The time (in hours) required to repair a machine is exponentially distributed with parameter $\lambda = 1/2$.	BTL4	Analyzing	CO 3

	(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?			
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) $\text{Var}(X)$	BTL5	Evaluating	CO 3
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	BTL5	Evaluating	CO 3
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 3
17.(a)	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 3
18.(a)	The length of time a person speaks over phone follows exponential distribution with mean 6 mins. What is the probability that the person will talk for (1) more than 8 mins (2) between 4 and 8 mins.	BTL-2	Understanding	CO 3
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 3

UNIT – IV LINEAR PROGRAMMING: Formulation–Graphical solution–Simplex method-Transportation and Assignment models.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
PART – A				
1.	Discuss the Linear programming problem	BTL -1	Remembering	CO 4
2.	State the applications of Linear programming problem	BTL -1	Remembering	CO 4
3.	What are the assumptions and requirements of LPP?	BTL -1	Remembering	CO 4
4.	Define Basic Feasible Solution	BTL -1	Remembering	CO 4

5.	Define optimum basic feasible solution	BTL -1	Remembering	CO 4
6.	What is the difference between feasible solution and basic feasible solution?	BTL -2	Understanding	CO 4
7.	Define Infeasible solution	BTL -1	Remembering	CO 4
8.	What is degenerate solution?	BTL -1	Remembering	CO 4
9.	Define unbounded solution	BTL -1	Remembering	CO 4
10.	Compare graphical and simplex methods for solving LPP	BTL -1	Remembering	CO 4
11.	A factory manufactures nails and screws. The profit earned is Rs.2/kg nails and Rs.3/kg screws. Three units of labors are required to manufacture 1 kg nails and 6 units to make 1 kg screws. Twenty four units of labor are available. Two units of raw materials are needed to make 1kg nails and 1 unit for 1 kg screws. Formulate the problem as an LP model which yields maximum profit from 10 units of raw materials.	BTL -2	Understanding	CO 4
12.	Formulate the LPP for the following problem. The standard weight of a special purpose brick is 5 kg and it contains 2 ingredients B1and B2, B1 cost Rs.5. per kg and B2 cost Rs.8 per kg. Strength considerations dictate that the brick contains not more than 4 kg of B1 and a minimum of 2 kg of B2. Since the demand for the product is likely to be related to the price of the brick.	BTL -2	Understanding	CO 4
13.	Obtain the Feasible region for $Max Z = 300x + 400y$ Subject to $2x + 3y \leq 1600,$ $3x + 2y \leq 1500,$ $x + y \leq 700, y \geq 300, x, y \geq 0$ by Graphical Method.	BTL -2	Understanding	CO 4
14.	Find the feasible region of the following LPP Minimize $Z = 6000x_1 + 4000x_2$ Subject to $3x_1 + x_2 \geq 40$ $x_1 + 2.5x_2 \geq 22$ $3x_1 + 3x_2 \geq 40, x_1, x_2 \geq 0$	BTL -1	Remembering	CO 4
15.	Define Transportation problem.	BTL -1	Remembering	CO 4
16.	Differentiate balanced transportation problem & Unbalanced Transportation Problem.	BTL -2	Understanding	CO 4
17.	Write down the working procedure of North West Corner rule for solving transportation problem?	BTL -2	Understanding	CO 4
18.	Write down the working procedure of Least Cost Method for solving transportation problem?	BTL -2	Understanding	CO 4
19.	Write down the assumptions in transportation problem.	BTL -2	Understanding	CO 4
20.	Compare Vogel approximation method (VAM) & Least Cost Method.	BTL -2	Understanding	CO 4
21.	Write down the Mathematical Formulation of	BTL -1	Remembering	CO 4

	Transportation Problem.								
22.	Write down the Mathematical formulation for Assignment Problem.					BTL -1	Remembering	CO 4	
23.	Evaluate the initial basic feasible solution of a transportation problem using North West Corner					BTL -2	Understanding	CO 4	
	Origin/Destination	D_1	D_2	D_3	Supply				
	O_1	2	7	4					
	O_2	3	3	1					
	O_3	5	4	7					
	O_4	1	6	2					
Demand	7	9	18						
24.	Construct the basic feasible solution for the following transportation problem.					BTL -2	Understanding	CO 4	
		1	2	3	4				SUPPLY
	1	2	3	11	7				6
	2	1	0	6	1				1
	3	5	8	15	9				10
	DEMAND	7	5	3	2				
25.	Find the initial basic feasible solution by North West Corner method					BTL -2	Understanding	CO 4	
	Destination Plant	1	2	3	4				Supply
	1	2	3	11	7				6
	2	1	0	6	1				1
	3	5	8	15	9				10
	Demand	7	5	3	2				17
PART -B									
1.	Apply Graphical Method to (i)Plot the graph (ii) Obtain the optimal solution for the LPP Maximize: $Z = 3x + 4y$ Subject to $2x + 5y \leq 60,$ $4x + 2y \leq 40,$ $x, y > 0.$					BTL -3	Applying	CO 4	
2.	Apply Graphical Method to (i)Plot the graph (ii) Predict the value of x_1 & x_2 that optimizes the objective function Minimize: $Z = 20x_1 + 10x_2$ Subject to $x_1 + 2x_2 \leq 40,$ $3x_1 + x_2 \geq 30,$ $4x_1 + 3x_2 \geq 60,$ $x_1, x_2 \geq 0.$					BTL -3	Applying	CO 4	

3.	Solve the following LPP by graphical method. Maximize $Z = 3x_1 + 5x_2$ Subject to $-3x_1 + 4x_2 \leq 12$ $x_1 \leq 4$ $2x_1 - x_2 \leq -2$ $2x_1 + 3x_2 \geq 12$ $x_1, x_2 \geq 0$	BTL -2	Understanding	CO 4
4.	Analyze the maximum value of $Z = 5x_1 + 7x_2$ Subject to $x_1 + x_2 \leq 4$ $3x_1 + 8x_2 \leq 24$ $10x_1 + 7x_2 \leq 35$ $x_1, x_2 \geq 0$ By Graphical method	BTL -4	Analyzing	CO 4
5.	Apply Graphical method to solve the following LPP Maximize $Z = 3x_1 + 4x_2$ subject to $5x_1 + 4x_2 \leq 200$ $3x_1 + 5x_2 \leq 150$ $5x_1 + 4x_2 \geq 100$ $8x_1 + 4x_2 \geq 80$ $x_1, x_2 \geq 0$	BTL -3	Applying	CO 4
6.	Maximize $Z = 6x_1 + 8x_2$ Subject to $5x_1 + 10x_2 \leq 60$ $4x_1 + 4x_2 \leq 40$ $x_1, x_2 \geq 0$ (i) Develop a Simplex Table (ii) Analyze and find the value of x_1 and x_2.	BTL -2	Understanding	CO 4
7.	Apply Simplex method to solve the following LPP Maximize $Z = 10x_1 + 15x_2 + 20x_3$ Subject to $2x_1 + 4x_2 + 6x_3 \leq 24$ $3x_1 + 9x_2 + 6x_3 \leq 30$ $x_1, x_2, x_3 \geq 0$	BTL -3	Applying	CO 4
8.	Analyze the following LPP and solve by Simplex Method: Maximize $Z = 3x_1 + 2x_2$ Subject to $x_1 + x_2 \leq 4$ $x_1 - x_2 \leq 2$ $x_1, x_2 \geq 0$	BTL -4	Analyzing	CO 4
9.	Apply the simplex algorithm to solve the following LPP Maximize $Z = x_1 + x_2 + 3x_3$ Subject to $3x_1 + 2x_2 + x_3 \leq 3$	BTL -3	Applying	CO 4

	$2x_1 + x_2 + 2x_3 \leq 2$ $x_1, x_2, x_3 \geq 0$																																																							
10.	Find the feasible solution for the following Transportation Problem by applying (i) North west corner method (ii) Least cost method and (iii) Vogel's approximation method. <table><tr><td></td><td colspan="4">Destination</td><td>Supply</td></tr><tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td></td></tr><tr><td>I</td><td>21</td><td>16</td><td>25</td><td>13</td><td>11</td></tr><tr><td>II</td><td>17</td><td>18</td><td>14</td><td>23</td><td>13</td></tr><tr><td>III</td><td>32</td><td>27</td><td>18</td><td>41</td><td>19</td></tr><tr><td>Demand</td><td>6</td><td>10</td><td>12</td><td>15</td><td></td></tr></table>		Destination				Supply		1	2	3	4		I	21	16	25	13	11	II	17	18	14	23	13	III	32	27	18	41	19	Demand	6	10	12	15		BTL -3	Applying	CO 4																
	Destination				Supply																																																			
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II	17	18	14	23	13																																																			
III	32	27	18	41	19																																																			
Demand	6	10	12	15																																																				
11.	Analyze the Initial Basic Feasible solution for following Transportation Problem by applying (i) North west corner method (ii) Least cost method (iii) Vogel's approximation method. (iv) Which method will you select if you want to Minimize Cost? <table><tr><td></td><td>D1</td><td>D2</td><td>D3</td><td>Supply</td></tr><tr><td>S1</td><td>7</td><td>3</td><td>2</td><td>2</td></tr><tr><td>S2</td><td>2</td><td>1</td><td>3</td><td>3</td></tr><tr><td>S3</td><td>3</td><td>4</td><td>6</td><td>5</td></tr><tr><td>Demand</td><td>4</td><td>1</td><td>5</td><td>10</td></tr></table>		D1	D2	D3	Supply	S1	7	3	2	2	S2	2	1	3	3	S3	3	4	6	5	Demand	4	1	5	10	BTL- 4	Analyzing	CO 4																											
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Demand	4	1	5	10																																																				
12.	Consider the transportation problem shown below <table><tr><td colspan="2"></td><td colspan="5">Market</td><td></td></tr><tr><td rowspan="5">Plant</td><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Supply</td></tr><tr><td>1</td><td>10</td><td>2</td><td>16</td><td>14</td><td>10</td><td>300</td></tr><tr><td>2</td><td>6</td><td>18</td><td>12</td><td>13</td><td>16</td><td>500</td></tr><tr><td>3</td><td>8</td><td>4</td><td>14</td><td>12</td><td>10</td><td>825</td></tr><tr><td>4</td><td>14</td><td>22</td><td>20</td><td>8</td><td>18</td><td>375</td></tr><tr><td colspan="2">Demand</td><td>350</td><td>400</td><td>250</td><td>150</td><td>400</td><td></td></tr></table> Find the initial basic feasible solution using each of the following methods and compare their total costs by applying (a) North west corner method			Market						Plant		1	2	3	4	5	Supply	1	10	2	16	14	10	300	2	6	18	12	13	16	500	3	8	4	14	12	10	825	4	14	22	20	8	18	375	Demand		350	400	250	150	400		BTL-3	Applying	CO 4
		Market																																																						
Plant		1	2	3	4	5	Supply																																																	
	1	10	2	16	14	10	300																																																	
	2	6	18	12	13	16	500																																																	
	3	8	4	14	12	10	825																																																	
	4	14	22	20	8	18	375																																																	
Demand		350	400	250	150	400																																																		

	(b) Least cost cell method (c) Vogel's approximation method																																						
13.	<table><tr><th colspan="5">Destination</th><th>Supply</th></tr><tr><td>I</td><td>2</td><td>1</td><td>25</td><td>13</td><td>11</td></tr><tr><td>II</td><td>1</td><td>1</td><td>14</td><td>23</td><td>13</td></tr><tr><td>III</td><td>3</td><td>2</td><td>18</td><td>41</td><td>19</td></tr><tr><td>Demand</td><td>6</td><td>1</td><td>22</td><td>15</td><td></td></tr></table>	Destination					Supply	I	2	1	25	13	11	II	1	1	14	23	13	III	3	2	18	41	19	Demand	6	1	22	15							BTL-3	Applying	CO 4
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	Demand	6	1	22	15																																		
(i) Solve the transportation problem and decide using VAM for initial solution																																							
(ii) Evaluate using NWC and Least Cost method for initial solution.																																							
14.	Analyze the optimal solution for the transportation problem starting with the initial solution obtained by VAM <table><tr><td></td><td>D_1</td><td>D_2</td><td>D_3</td><td>D_4</td><td>Supply</td></tr><tr><td>O_1</td><td>2</td><td>2</td><td>2</td><td>1</td><td>3</td></tr><tr><td>O_2</td><td>10</td><td>8</td><td>5</td><td>4</td><td>7</td></tr><tr><td>O_3</td><td>7</td><td>6</td><td>6</td><td>8</td><td>5</td></tr><tr><td>Demand</td><td>4</td><td>3</td><td>4</td><td>4</td><td>15</td></tr></table>							D_1	D_2	D_3	D_4	Supply	O_1	2	2	2	1	3	O_2	10	8	5	4	7	O_3	7	6	6	8	5	Demand	4	3	4	4	15	BTL-4	Analyzing	CO 4
	D_1	D_2	D_3	D_4	Supply																																		
O_1	2	2	2	1	3																																		
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O_3	7	6	6	8	5																																		
Demand	4	3	4	4	15																																		
15.	The assignment cost of assigning any one operator to any one machine is given in the following table. MACHINE↓ OPERATORS → <table><tr><td></td><td>I</td><td>II</td><td>III</td><td>IV</td></tr><tr><td>A</td><td>10</td><td>5</td><td>13</td><td>15</td></tr><tr><td>B</td><td>3</td><td>9</td><td>18</td><td>3</td></tr><tr><td>C</td><td>10</td><td>7</td><td>3</td><td>2</td></tr><tr><td>D</td><td>5</td><td>11</td><td>9</td><td>7</td></tr></table>							I	II	III	IV	A	10	5	13	15	B	3	9	18	3	C	10	7	3	2	D	5	11	9	7	BTL-4	Analyzing	CO 4					
		I	II	III	IV																																		
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	C	10	7	3	2																																		
	D	5	11	9	7																																		
Analyze the optimal assignment by Hungarian method.																																							
16.	Five new machines are to be located in a machine shop. There are five possible locations in which the machines can be located, a_j , the cost of placing machine i in place j is given in the table below. Solve the assignment problem by applying Hungarian method . <table><tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>1</td><td>15</td><td>10</td><td>25</td><td>25</td><td>10</td></tr><tr><td>2</td><td>1</td><td>8</td><td>10</td><td>20</td><td>2</td></tr><tr><td>3</td><td>8</td><td>9</td><td>17</td><td>20</td><td>10</td></tr></table>							1	2	3	4	5	1	15	10	25	25	10	2	1	8	10	20	2	3	8	9	17	20	10	BTL-3	Applying	CO 4						
		1	2	3	4	5																																	
	1	15	10	25	25	10																																	
	2	1	8	10	20	2																																	
	3	8	9	17	20	10																																	

	4	14	10	25	27	15			
	5	10	8	25	27	12			
17.	A batch of 4 jobs can be assigned to 5 different machines. The set up time (in hours) for each job on various machines is given below. Find the optimal solution. Machines JOB ↓ 1 2 3 4 5 1 10 11 4 2 8 2 7 11 10 14 12 3 5 6 9 12 14 4 13 15 11 10 7						BTL-3	Applying	CO 4
18.	A travelling salesman has to visit 5 cities. He wishes to start from a particular city visit each city once and then return to his starting point, cost of going from one city to another is shown below. the least cost route A B C D E A ∞ 4 10 14 2 B 12 ∞ 6 10 4 C 16 14 ∞ 8 14 D 24 8 12 ∞ 10 E 2 6 4 16 ∞								CO 4

UNIT – V FOURIER SERIES : Fourier trigonometric series: Periodic function as power signals–Convergence of series–Even and odd function – Half range Cosine and sine series –Exponential Fourier series–Parseval’s theorem and Harmonic Analysis

Q.No.	Question	Bloom’s Taxonomy Level	Competence	Course Outcome
PART – A				
1.	State the Dirichlet’s conditions for a function $f(x)$ to be expanded as a Fourier series.	BTL -1	Remembering	CO 5
2.	Write the Fourier series for a function $f(x)$ defined in $-l < x < l$	BTL -2	Understanding	CO 5
3.	If $f(x)$ is an odd function defined in $(-l, l)$. What are the values of a_0 and a_n ?	BTL -2	Understanding	CO 5
4.	Find a Fourier sine series for $f(x) = 1, 0 < x < \pi$.	BTL -2	Understanding	CO 5
5.	If the periodic function $f(t) = \begin{cases} 0 & -\pi < t < 0 \\ t, & 0 < t < \pi \end{cases}$ here $f(t + 2\pi) = f(t)$ is expanded as a Fourier series, find the value of a_n .	BTL -2	Understanding	CO 5
6.	Find the value of a_0 in the Fourier series expansion of $f(x) = e^x$ in $(0, 2\pi)$.	BTL -2	Understanding	CO 5
7.	Define energy signals and power signals?	BTL -2	Understanding	CO 5
8.	Define a periodic function as power signals.	BTL -1	Remembering	CO 5

9.	Write the power signals Exponential Fourier Series.	BTL -1	Remembering	CO 5
10.	Distinguish Periodic and Non Periodic functions, with example.	BTL -1	Remembering	CO 5
11.	Calculate average power of period $T=2$, $f(t) = 2\cos 5\pi t + \sin 6\pi t$ using time domain analysis.	BTL -2	Understanding	CO 5
12.	Define self adjoint operator.	BTL -1	Remembering	CO 5
13.	Find the Fourier constants b_n for $x \sin x$ in $(-\pi, \pi)$	BTL -2	Understanding	CO 5
14.	Find the value of b_n for $f(x) = x $ in $(-\pi, \pi)$	BTL -1	Remembering	CO 5
15.	State convergence of the series.	BTL -1	Remembering	CO 5
16.	If $(\pi - x)^2 = \frac{\pi^2}{3} + 4 \sum_{n=1}^{\infty} \frac{\cos nx}{n^2}$ in $0 < x < 2\pi$ then deduce that value of $\sum_{n=1}^{\infty} \frac{1}{n^2}$.	BTL -2	Understanding	CO 5
17.	Determine the value of a_n in the Fourier series expansion of $f(x) = x^3$ in $(-\pi, \pi)$.	BTL -2	Understanding	CO 5
18.	If $(\pi - x)^2 = \frac{\pi^2}{3} + 4 \sum_{n=1}^{\infty} \frac{\cos nx}{n^2}$ in $0 < x < 2\pi$ then deduce the value of $\sum_{n=1}^{\infty} \frac{1}{n^2}$.	BTL -2	Understanding	CO 5
19.	If the function $f(x) = x$ in the interval $0 < x < 2\pi$ then find the constant term of the Fourier series expansion of the function	BTL -2	Understanding	CO 5
20.	Expand $f(x) = 1$, in $(0, \pi)$ as a half sine series.	BTL -2	Understanding	CO 5
21.	Write note on cosine and sine series.	BTL -1	Remembering	CO 5
22.	Define exponential Fourier series	BTL -1	Remembering	CO 5
23.	State Parseval's theorem	BTL -1	Remembering	CO 5
24.	State Parseval's identity for the half-range cosine expansion of $f(x)$ in $(0, l)$.	BTL -1	Remembering	CO 5
25.	What is meant by Harmonic Analysis?	BTL -1	Remembering	CO 5
PART -B				
1.	Find the Fourier series of the periodic Ramp function $f(t) = \begin{cases} 0, & -\pi < t < 0 \\ t, & 0 < t < \pi \end{cases}$, $f(t+2\pi) = f(t)$ By applying (i) time domain analysis (ii) Frequency domain analysis.	BTL -3	Applying	CO 5
2.	A periodic function $f(t)$ of period 2 is defined by $f(t) = \begin{cases} 3t & 0 \leq t \leq 1 \\ 3 & 1 \leq t \leq 2 \end{cases}$, $f(t+2) = f(t)$. Determine a Fourier series expansion for the function and sketch a graph of $f(t)$ for $-4 \leq t \leq 4$.	BTL -3	Applying	CO 5
3.	Find the Fourier series of $f(x) = x + x^2$ in $(-\pi, \pi)$ with period 2π .	BTL -4	Analyzing	CO 5
4.	Find the Fourier series of $f(x) = 1 + x + x^2$ in $(-\pi, \pi)$.	BTL -3	Applying	CO 5
5.	Find the Fourier series of $f(x) = x $ in $-\pi \leq x \leq \pi$.	BTL -3	Applying	CO 5

6.	Find the Fourier series of the function $f(x) = (\pi - x)^2$ in $(0, 2\pi)$ with periodicity 2π	BTL -4	Analyzing	CO 5																
7.	Find a Fourier series with period 3 to represent $f(x) = 2x - x^2$ in $(0, 3)$.	BTL -4	Analyzing	CO 5																
8.	Find the Fourier series expansion of the periodic function $f(x)$ of period $2l$ defined by $f(x) = \begin{cases} l - x, & -l \leq x \leq 0 \\ l + x, & 0 \leq x \leq l \end{cases}$ Hence Deduce $\frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$	BTL -3	Applying	CO 5																
9.	Obtain the Fourier series expansion of $f(x) = \begin{cases} -x + 1 & \text{for } -\pi < x < 0 \\ x + 1 & \text{for } 0 < x < \pi \end{cases}$	BTL -4	Analyzing	CO 5																
10.	Expand $f(x) = \begin{cases} 1 + \frac{2x}{\pi}, & -\pi < x < 0 \\ 1 - \frac{2x}{\pi}, & 0 < x < \pi \end{cases}$ as a full range Fourier series in the interval $(-\pi, \pi)$.	BTL -4	Analyzing	CO 5																
11.	Calculate the average power of the periodic signal, period $T = 2$ for $f(t) = 2 \cos 6\pi t + \sin 5\pi$	BTL -4	Analyzing	CO 5																
12.	Find half range cosine series given $f(x) = \begin{cases} x, & 0 \leq x \leq 1 \\ 2 - x, & 1 \leq x \leq 2 \end{cases}$	BTL -3	Applying	CO 5																
13.	Obtain the cosine series for $f(x) = x$ in $0 < x < \pi$ and deduce that $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^4} = \frac{\pi^4}{96}$	BTL -3	Applying	CO 5																
14.	Find the Fourier series for $f(x) = x^2$ in $(-\pi, \pi)$. Hence deduce i) $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots$ ii) $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots$ iii) $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \frac{1}{4^4} + \dots$	BTL -4	Analyzing	CO 5																
15.	Analyze the Fourier series of $f(t) = t^2, 0 < t < 1$ (i) sine series with period $T = 2$ (ii) cosine series with period $T = 2$ (iii) full trigonometric series with period $T = 1$	BTL -4	Analyzing	CO 5																
16.	The table gives the time (t) in seconds as x and current (A) in amps as y, Obtain the first two harmonics from the given data <table><tr><td>t sec x:</td><td>0</td><td>T/6</td><td>T/3</td><td>T/2</td><td>2T/3</td><td>5T/6</td><td>T</td></tr><tr><td>Amps y:</td><td>1.98</td><td>1.30</td><td>1.05</td><td>1.30</td><td>-0.88</td><td>-0.25</td><td>1.98</td></tr></table>	t sec x:	0	T/6	T/3	T/2	2T/3	5T/6	T	Amps y:	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98	BTL -3	Applying	CO 5
t sec x:	0	T/6	T/3	T/2	2T/3	5T/6	T													
Amps y:	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98													
17.	Compute the first two harmonics of the Fourier series of $f(x)$ from the table given <table><tr><td>x</td><td>0</td><td>$\pi/3$</td><td>$2\pi/3$</td><td>π</td><td>$4\pi/3$</td><td>$5\pi/3$</td><td>2π</td></tr><tr><td>f(x)</td><td>1</td><td>1.4</td><td>1.9</td><td>1.7</td><td>1.5</td><td>1.2</td><td>1</td></tr></table>	x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π	f(x)	1	1.4	1.9	1.7	1.5	1.2	1	BTL -3	Applying	CO 5
x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π													
f(x)	1	1.4	1.9	1.7	1.5	1.2	1													
18.	Find the Fourier cosine series up to second harmonic to represent the function given by the following data:	BTL -3	Applying	CO 5																

	$l = 6$									
	x	0	1	2	3	4	5			
	y	4	8	15	7	6	2			

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