DEPARTMENT OF MATHEMATICS

Semester – I :   **060090106 – CC2 Elementary Algebra**

Question Bank

Unit-1	Complex Numbers
[A]	**1 – Mark Questions**
1.	Define complex number.
2.	When two complex number are said to be equal?
3.	Show that Im(iz) = Re(z).
4.	Define conjugate complex number.
5.	Show that Re(iz) = − Im(z).
6.	Given that z = x + iy find Re($i\bar{z}$).
7.	Define modulus of a complex number.
8.	Perform the calculations (1 + i + i2 + i3)100.
9.	Find the $\bar{z}$ if z = -3 – 5i.
10.	What is the value of k in $\theta = \tan^{-1}\left(\frac{y}{x}\right) + k\pi$, if $x > 0 \ and \ y \geq 0$?
11.	Find the $\bar{z}$ if z = 7i.
12.	What is the value of k in $\theta = \tan^{-1}\left(\frac{y}{x}\right) + k\pi$, if $x < 0 \ and \ any \ y$?
13.	Find the $|z|$if z = -3 -4i.
14.	What is the value of k in $\theta = \tan^{-1}\left(\frac{y}{x}\right) + k\pi$, if $x > 0 \ and \ y < 0$?
15.	Find the $|z|$ if z = -8.
16.	How to represent complex number in polar form?
17.	Given that z = x + iy find Im($(\bar{\iota}z)$)
18.	Find the polar coordinates of the points: $M_1(2, -2)$.
19.	Given that z = x +iy find Re $(\bar{\iota}z)$
20.	Express complex number in polar form: $\sqrt{2} + i$
[B]	**3 – Marks Questions**
1.	If z1 = 4 + 6i and z2 = 2 – 3i, then find z1z2, z12 and z22.
2.	Give an example of relation that is 1) symmetric and antisymmetric 2) reflexive and symmetric but not transitive and 3) symmetric and transitive but not reflexive.
3.	If z1 = 1/3(2 + 4i) and z2 = 1/2(1 – 5i), then find z1z2, z12 and z22.
4.	In each part, find the real number k1 and k2 that satisfy the equation. (1) k1 + k2(1 + i) = 3 – 2i (2) k1(2 + 3i) + k2(1 – 4i) = 7 +5i
5.	Prove that $\frac{1}{2}(z + \bar{z}) = Re(z)$.
6.	Given that z1 = 1 – 2i and z2 = 4 + 5i find (1) z1 + z2 (2) z1 – z2 (3) 1/2(z1) - 3/2(z2)
7.	Prove that $\frac{1}{2}(z - \bar{z}) = Im(z)$.
8.	Let A = $\begin{bmatrix} 1 & i \\ -i & 3 \end{bmatrix}$, B = $\begin{bmatrix} 2 & 2 + i \\ 3 - i & 4 \end{bmatrix}$ then find (1) A + 3iB (2) B2 – A2
9.	Perform the calculations and express the result in the form a +bi (1) (1 + 2i)(4 – 6i)2 (2) (2 - i)(3 + i)(4 – 2i)
10.	Find the Cartesian co-ordinates for the given points:- P($2, \frac{\pi}{3}$)
11.	Perform the calculations and express the result in the form a +bi (1) (1 – 3i)3 (2) (3 – 2i)2 – (3 + 2i)2
12.	Find the modulus of the following complex numbers: $\frac{3-i}{2+i} + \frac{3+i}{2-i}$.

13.	Given that z(1) = 1 – 5i and z(2) = 3 + 4i, find (1) z(1) / $\overline{z(2)}$ (2) $\overline{(z(1)/z(2)}$

14.	If R is a relation on the set {1, 2, 3, 4, 5} defined by (a, b) ∈ R if a + b ≤ 6,
	   a) List the elements of R, R-1, R'.
	   b) The domain and range of R and R-1.
	   c) The domain and range of R'.

15.	Given that z(1) = 1 – 5i and z(2) = 3 + 4i, find (1) z(1) / |z(2)| (2) | z(1)/z(2)|
16.	Which of the ordered pairs given by {1, 2, 3} X {1, 2, 3} belong to the following relations? 1) aRb iff $a \le b$ 2) aRb iff a = b + 1 3) aRb iff a + b ≤ 4
17.	Find the following complex numbers where $z_1 = 3 + 2i, z_2 = -2 + i, z_3 = \frac{1}{3} - 2i$ (1) $z_1 + z_2$ (2) $z_1 - 2z_2$ (3) $z_2 + z_3$
18.	Compute the following products using polar representation of a complex numbers: $$\left(\frac{1}{2} - i\frac{\sqrt{3}}{2}\right)(-3 + 3i)(2\sqrt{3} + 2i)$$
19.	If $z_1 = 1 + i$ and $z_2 = 2 + i$, find $z_1 z_2$ and $\frac{z_1}{z_2}$.
20.	Compute the following products: $\left(\frac{1}{2} - i\frac{\sqrt{3}}{2}\right)(-3 + 3i)(2\sqrt{3} + 2i)$
[C]	**5 – Marks Questions**
1.	State and prove De Movire's theorem. Also prove that De-Movire's formula holds for negative integers exponent.
2.	Find the square roots of the given complex numbers:- $7 - 24i$
3.	Let A = $\begin{bmatrix} 3+2i & 0 \\ -i & 2 \\ 1+i & 1-i \end{bmatrix}$, B = $\begin{bmatrix} -i & 2 \\ 0 & i \end{bmatrix}$, C = $\begin{bmatrix} -1-i & 0 & -i \\ 3 & 2i & -5 \end{bmatrix}$, then find (1) A(BC) (2) (CA)B2 (3) (1 + i)AB + (3 – 4i)A
4.	State and prove De Movire's theorem. Also prove that De-Movire's formula holds for negative integers exponent.
5.	Find the square roots of the given complex numbers:- $7 - 24i$
6.	Let A = $\begin{bmatrix} 3+2i & 0 \\ -i & 2 \\ 1+i & 1-i \end{bmatrix}$, B = $\begin{bmatrix} -i & 2 \\ 0 & i \end{bmatrix}$, C = $\begin{bmatrix} -1-i & 0 & -i \\ 3 & 2i & -5 \end{bmatrix}$, then find (1) A(BC) (2) (CA)B2 (3) (1 + i)AB + (3 – 4i)A
7.	Find the fourth roots of the given complex numbers:- $z = -16$.
8.	Use De Movire's theorem to obtain an expression of $cos3\theta$ in terms of $cos\theta$ alone.
9.	Determine whether the relation R on the set of all integers is reflexive, symmetric and/or transitive, where aRb if and only if (i) $a \ne b$ (ii) $ab \ge 0$ (iii) $\|a - b\| = 1$ (iv) a = b2 (v) $a \ge b^2$.

10.	Which of the following relations on {0, 1, 2, 3} are equivalence relations? Find the properties of an equivalence relation that the others lack.
	   a) R1 = {(0, 0), (1, 1), (2, 2), (3, 3)}
	   b) R2 = {(0, 0), (0, 2), (2, 0), (2, 2), (2, 3), (3, 2), (3,3)}
	   c) R3 = {(0, 0), (1, 1), (1, 2), (2, 1), (2, 2), (3, 3)}

	d) R4 = {(0, 0),(1, 1), (1,3), (2, 2), (2, 3),(3, 1), (3, 2), (3, 3)}
	e) R5 = {(0, 0), (0, 1), (0, 2), (1, 0), (1, 1), (1, 2), (2, 0), (2, 2), (3, 3)}
11.	Prove that $cos4\theta = 8cos^4\theta - 8cos^2\theta + 1$ $sin4\theta = 4cos^3\theta - 4cos\theta sin^3\theta$.
12.	Find the cube roots of the given complex numbers:- $z = \frac{1}{2} - i\frac{\sqrt{3}}{2}$.
13.	Determine whether the relation R on the set of people is reflexive, symmetric, and/or transitive, where aRb if, a) a is taller than b b) a and b were born on the same day c) a has the same first name of b d) a is spouse of b e) a and b have a common grandparent.
14.	Prove that $cos5\theta = 16cos^5\theta - 20cos^3\theta + 5cos\theta$ $sin5\theta = 16cos^5\theta - 20sin^3\theta + 5sin\theta$.
15.	Which of the followings relation on the set {1, 2, 3, 4} is/are equivalent relations? Find the properties of an equivalent relation that others lack. a) {(2, 4,) (4, 2)} b) {(1, 1), (2, 2), (3, 3), (4, 4)} c) {(2, 2), (2, 3), (2, 4), (3, 2), (3, 3), (3,4)} d) {(1, 1), (1, 2), (2, 1), (2, 2), (3, 1),(3, 4)} e) {(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)}
16.	Use De Movire's formula to find $\left(\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}i\right)$-6.
17.	Find the fourth roots of the given complex numbers:-$z = \sqrt{3} + i$.
18.	Find |z|for ; $z = \frac{(2\sqrt{3}+2i)^8}{(1-i)^6} + \frac{(1+i)^6}{(2\sqrt{3}-2i)^8}$.
19.	Write all the properties of relation.
20.	Solve the systems of linear equations by Cramer's rule. x + y + z = 3, x + y – z = 2 + 2i, x – y +z = −1.
Unit-2	**Functions and Integers**
[A]	**1 – Mark Questions**
1.	Define function.
2.	Define divisibility.
3.	Define one to one function.
4.	Define prime number.
5.	Define onto function.
6.	Define Greatest common divisor.
7.	Define Least common multiple.
8.	Define injective.
9.	Define congruence.
10.	Define surjective.
11.	Define composition of function.
12.	Define bijective.
13.	Define identity function.
14.	Define injection.
15.	Define inverse of function.
16.	Define surjection.

17.	When a function is invertible?
18.	Define bijection.
19.	Justify the statement "Composition of function is commutative".
[B]	**3 – Marks Questions**
1.	Find gcd(1575,231).
2.	Prove that composition of functions is associative.
3.	Find the prime factorization of each of the following integers:- a) 6647 b) 45500 c) 10!
4.	Prove that the inverse of a function f, if exists, is unique.
5.	Give an example of a function N→N as asset of ordered pairs which is a) One-to-one but onto b) Onto but not one-to-one c) Both one-to-one and onto
6.	Prove that congruence relation is equivalence relation.
7.	Determine whether or not each of the following relations is a function with domain {1, 2, 3, 4}. If any relation is not a function, explain why. 1) {(1, 1), (2, 1),(3, 1), (4, 1), (3, 3)} 2) {(1, 2), (2, 3), (4, 2)} 3) {(1, 1), (2, 1), (3, 1), (4, 1)}
8.	Prove that $log_3 5$ is a irrational.
9.	Determine whether or not each of the following relations is a function. If a relation is a function, find it range. 1) {(x, y) |x, y ∈ Z, y = x2 +7}, which is a relation from Z to Z. 2) {(x, y) |x, y ∈ R, y2 =x}, which is a relation from R to R. 3) {(x, y) |x, y ∈ R, y = 3x +1}, which is a relation from R to R.
10.	Prove that $\sqrt{5}$ is irrational.
11.	If f is a function from S = {0, 1, 2, 3, 4, 5} to S, defined by f(x) = (4x)(mod6), write f as a set of ordered pairs. Is the function one-to-one or onto?
12.	Find an inverse of 19 modulo 141.
13.	If f, g, h: R → R be the functions defined by $f(x) = x^3 - 4x$, $g(x) = \frac{1}{x^2+1}$, $h(x) = x^4$ then find $(f \cdot g) \cdot h(x)$ and $f \cdot (g \cdot h)(x)$ and check they are equal.
14.	Solve the congruence 79x ≡ 15 (mod 722).
15.	If f is a function from A = {0, 1, 2, 3, 4,} to A, defined by f(x) = (4x)(mod6), write f as a set of ordered pairs. Is the function one-to-one or onto?
16.	Solve the congruence 6x ≡ 5 (mod 9).
17.	Determine whether or not each of the following function is one-to-one and/or onto: 1) f: Z → Z, given by f(x) = x2 – 5x + 5. 2) f: Z → Z, given by f(x) = 3x3 – x 3) f: R → R, given by f(x) = 2x – 3
18.	Find the prime factorization of each of the integers:- 1) 420 2) 135 3) 1925
19.	Show that $\sqrt{2}$ is an irrational number.
20.	Solve the congruence 9x ≡ 12 (mod 21).
[C]	**5 – Marks Questions**
1.	State and prove Euclid's algorithm.
2.	Let S = {1,2,3,4,5} and let f, g, h: s → s be the functions defined by f = {(1,2), (2,1), (3,4), (4,5), (5,3)} g = {(1,3), (2,5), (3,1), (4,2), (5,4)}

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	h = {(1,2), (2,2), (3,4), (4,3), (5,1)} (a) Find f · g and g · f.Are these functions equal? (b) Explain why f and g have inverse but h does not.Find f^{-1} and g^{-1}. (c) Show that $(f \cdot g)^{-1} = g^{-1} \cdot f^{-1}$
3.	Prove, by mathematical induction, that 12 – 22 + 32 -......+ (-1)n-1n2 = $\frac{(-1)^{n-1} . n(n+1)}{2}$.
4.	Use the Euclidian's algorithm to find gcd(12345,54321). Express the gcd as a linear combination of the given numbers.
5.	Use mathematical induction to prove that (3n + 7n – 2) is divisible by 8, for n ≥ 1.
6.	If x = {1 ,2 ,3}, y = {p, q}, z = {a, b} and if f: x → y is defined by f = {(1, p), (2, p), (3, q)} and g: y → z is defined by g = {(p, b), (q, b)} then find g · f and f · g .
7.	State and prove division algorithm.
8.	If A = {1,2,3,4,5}, B = {1,2,3,8,9} and the functions f: A → B and g: A → A are defined by f = {(1,8), (3,9), (4,3), (2,1), (5,2)} and g = {(1,2), (3,1), (2,2), (4,3), (5,2)} Find f · g, g · f, f · f and g · g ,if exists.
9.	Use mathematical induction to prove that n3 + (n +1)3 + (n + 2)3 is divisible by 9, for n ≥ 1.
10.	State and prove Fundamental theorem of arithmetic
11.	Let f(x) = x + 2, g(x) = x − 2, h(x) = 3x, x ∈ R then prove that i) $f \cdot g = g \cdot f$, ii) $g \cdot h \neq h \cdot g$ iii) $h \cdot f \neq f \cdot h$ iv) $(f \cdot g) \cdot h = f \cdot (g \cdot h)$.
12.	If f: A → B, g: B → C and h: C → D are composite functions then prove that ho(gof) = (hog)of .
13.	If A = {$x \in R | x \neq \frac{1}{2}$} and f: A → R is defined by f(x) = $\frac{4x}{2x-1}$, i) find the range(f); ii) show that f is invertible and iii) find dom(f-1), range (f-1), and a formula for f-1.
14.	Using prime factorization, find the gcd and lcm of i) (321, 1575) and ii) (337500, 21600), verify also that gcd(m, n) ·lcm(m, n) = mn.
15.	If f: Z → N is defined by f(x) = $\begin{cases} 2x - 1, if\ x > 0 \\ -2x, \ if \ \ x \leq 0 \end{cases}$ Prove that f is one-to-one and onto and determine f-1.
16.	If f, g, h: R → R be the functions defined by f(x) = x + 2 , g(x) = $\frac{1}{x^2+1}$, h(x) = 3 then Find (1) g · h · f(x) (2) h · g · f(x) (3)g · f^{-1} · f(x) .
17.	Find the integers m and n such that (1) $512m + 320n = 64$ and (2) $28844m + 15712n = 4$.
18.	Prove, by mathematical induction, that $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots + \frac{1}{n(n+1)} = \frac{n}{n+1}$.
19.	i) If gcd(a, b) =1, prove that gcd(2a + b, a +2b) = 1 or 3. Ii) if gcd(a, 4) = gcd(b, 4) = 2, prove that gcd(a + b, 4) =4.
20.	Prove that gcd(a, b) can be expresses as an integral linear combination of a and b i.e.gcd(a , b) = ma + nb, where m and n are integers.
21.	Prove that the necessary and sufficient condition for the function f: A → B to be invertible is that f is one-to-one and onto.

22.	Prove that i) cube of an integer has one of the forms 9k, 9k +1, 9k + 8 and ii) if an integer is simultaneously a square and a cube (as in the case of 64 = 82 = 43), then it must be of form 7k, 7k + 1.
23.	Find the remainder when the sum 1! + 2! + 3!+......+1000! Is divided by 4 and by 5.
24.	Prove, by mathematical induction, that $1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + 3 \cdot 4 \cdot 5 + \cdots + n(n + 1)(n + 2) = \frac{1}{4} n(n + 1)(n + 2)(n + 3).$

Unit-3	**Matrix Algebra**
[A]	**1 – Mark Questions**
1.	Define the Following Terms: 1) Square Matrix(with Example) 2) Diagonal Matrix(with Example) 3) Identity Matrix(with Example) 4) Null Matrix(With Example) 5) Upper Triangular Matrix(With Example) 6) Singular Matrix(With Example) 7) Skew – Symmetric Matrix 10)Hermitian Matrix 11)Unitary Matrix 12)Orthogonal Matrix 13)Inverse of a Matrix 14)Symmetric Matrix 15)Skew – Hermitian Matrix
[B]	**3 – Marks Questions**
1.	Prove that for any matrix A, A+A^θ is hermitian matrix.
2.	Prove that if A is hermitian matrix then, iA is skew-hermitian matrix.
3.	Prove that matrix addition is commutative
4.	Prove that matrix addition is Associative
5.	Prove that $A = \frac{1}{9}\begin{bmatrix} -8 & 4 & 1 \\ 1 & 4 & -8 \\ 4 & 7 & 4 \end{bmatrix}$ is orthogonal matrix.
6.	Prove that for any matrices A and B, $(A + B)^T = A^T + B^T$
7.	Prove that $\begin{bmatrix} ab & b^2 \\ a^2 & -ab \end{bmatrix}$ is nilpotant matrix.
8.	Find AB amd BA where $A = \begin{bmatrix} 1 & 0 \\ 4 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & -2 \\ 1 & -1 \end{bmatrix}$.
9.	For which values of h , the system is consistent. x - 3y = h , -2x + 6y = -5
10.	for square matrices A and B and scalar K, Prove that $K(A + B) = KA + KB.$
11.	Define upper triangular matrix with example
12.	For which values of h ,the system is consistent. x +hy = -2 , - 4x + 2y = 10
13.	Prove that for any matrix A, A - A^θ is skew - hermitian matrix.
14.	Prove that $A = \frac{1}{9}\begin{bmatrix} -8 & 4 & 1 \\ 1 & 4 & -8 \\ 4 & 7 & 4 \end{bmatrix}$ is orthogonal matrix.
15.	Prove that for any matrix A and scalar K , $(KA)^T = KA^T$

16.	For any square matrix A, prove that $\lvert adj\ A \rvert$
17.	Find AB amd BA where $A = \begin{bmatrix} 2 & 0 \\ 4 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 2 \\ 1 & 0 \end{bmatrix}$.
18.	Find the adjoint of a matrix $A = \begin{bmatrix} 2 & 3 & 1 \\ 4 & 5 & -3 \\ -1 & 6 & 7 \end{bmatrix}$
19.	For which values of h ,the system is consistent.
20.	x +h = -2 , -4x + 2y = 10
21.	Find rank of a matrix $\begin{bmatrix} 4 & 3 & -1 \\ 3 & 4 & 1 \\ 5 & 1 & -4 \end{bmatrix}$
22.	Find rank of a matrix $\begin{bmatrix} 5 & 3 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$
23.	Find rank of a matrix $\begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$
24.	Find the followings.
25.	(a)The largest possible value of rank of matrix of order 5×7.
26.	(b) The largest possible value of rank of matrix of order 2×8
27.	(a)The largest possible value of rank of matrix of order 5×7.
28.	(b) The largest possible value of rank of matrix of order 2×8
29.	Convert the matrix in Row Echelon Form: 1) $\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$ 2) $\begin{bmatrix} 2 & 2 & 1 \\ 4 & 2 & 3 \\ 1 & 1 & 1 \end{bmatrix}$
30.	Find Rank by Row Echelon Form: 1) $\begin{bmatrix} 4 & 2 & 3 \\ 8 & 4 & 6 \\ -2 & -1 & -\frac{3}{2} \end{bmatrix}$ 2) $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & 4 \\ 4 & 3 & 2 \end{bmatrix}$
31.	Find Rank by Determinant Method: 1) $\begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$ 2) $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{bmatrix}$
32.	Convert the matrix in Reduced Row Echelon Form: 1) $\begin{bmatrix} 3 & -1 & -1 \\ 1 & 1 & 2 \\ 5 & 1 & 3 \end{bmatrix}$
33.	Prove that the following matrix is Orthogonal. 1) $\begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$
[C]	**5 – Marks Questions**
1.	Prove that any square matrix can be expressed as a sum of symmetric and skew symmetric matrices.
2.	Prove that any square matrix can be expressed as a sum of hermitian and skew

	hermitian matrices.
3.	Find reduced row echelon form of A = $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$
4.	Find row echelon form of A = $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$
5.	Find row echelon form of A = $\begin{bmatrix} 1 & 2 & 1 & 0 \\ -2 & 4 & 3 & 0 \\ 1 & 0 & 2 & 8 \end{bmatrix}$
6.	Find the value of A.(adj A) for a matrix A = $\begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}$
7.	Find inverse of matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$
8.	Find the adjoint of a matrix $A = \begin{bmatrix} 2 & 3 & 1 \\ 4 & 5 & -3 \\ -1 & 6 & 7 \end{bmatrix}$
9.	Check the consistency of the system: 4x - 2y +6 z = 8, x+y -3z = -1, 15x -3y + 9z = 21
10.	Solve the following system of linear equations by Gauss elimination method : x + y +2 z = 9, 2x + 4y -3z = 1, 3x + 6y -5z = 0
11.	Solve the following system of linear equations by Gauss elimination method : x + y + z = 6, x - y + 2z = 5, 3x + y + z = 8, 2x -2y + 3z = 7
12.	Solve the following equations by gauss Jordan method: 6x + y + z = -4, 2x -3 y - z = 0 , -x -7y -2z = 7
13.	Solve the following system of linear equations by Gauss Jordan method x + 2y + z = 8, 2x + 2y + 3z = 13,3x + 4y + 3z = 1
14.	Solve the following equations by gauss elimination: 3x - 3 y + 4z = 1, 2 x - 3y + 4z = 0 , -y + z = 0
15.	Check the consistency of the system: x - 2y + z = 0, 2y -8z = 8, -4x + 5y + 9z = -9
16.	Prove that inverse of a matrix is unique.
17.	Find inverse of matrix $A = \begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$ using elementary row oprerations
18.	Find row echelon form of A = $\begin{bmatrix} 1 & 2 & 4 & 8 \\ 2 & 4 & 6 & 8 \\ 3 & 6 & 9 & 12 \end{bmatrix}$
19.	Solve the following equations: 3x - y -z = 0, x + y + 2z = 0 , 5x +y +3z = 0
20.	Solve the following system of linear equations by Gauss Jordan method x + 2y + z = 8, 2x + 2y + 3z = 13,3x + 4y + 3z = 1
21.	Solve the following system of linear equations 2x - y - z = 2, x + 2y + z = 2 ,4x -7y -5z = 2
22.	Prove that for any square A, prove that $(A^{-1})^T = (A^T)^{-1}$
23.	Express the following matrices as the sum of a symmetric and a skew symmetric matrix:

1) $\begin{bmatrix} 0 & 5 & -3 \\ 1 & 1 & 1 \\ 4 & 5 & 9 \end{bmatrix}$	2) $\begin{bmatrix} 1 & 2 & 1 \\ 0 & 2 & 2 \\ 2 & 1 & 1 \end{bmatrix}$

24.	Express the following matrices as the sum of a Hermitian and Skew Hermitian Matrix: 1) $\begin{bmatrix} 2+3i & 0 & 4i \\ 5 & i & 8 \\ 1-i & -3+i & 6 \end{bmatrix}$ 2) $\begin{bmatrix} 2 & 4+i & 6i \\ 6 & 5-i & 4 \\ 0 & 1-i & 8i \end{bmatrix}$
25.	Prove that the following matrices are Unitary matrices and hence find A^{-1}. 1) $\begin{bmatrix} \frac{2+i}{3} & \frac{2i}{3} \\ \frac{2i}{3} & \frac{2-i}{3} \end{bmatrix}$ 2) $\frac{1}{3}\begin{bmatrix} \sqrt{2} & -i\sqrt{2} & 0 \\ i\sqrt{2} & -\sqrt{2} & 0 \\ 0 & 0 & 2 \end{bmatrix}$
26.	Prove that the following matrices are orthogonal and hence find A^{-1}. 1) $\frac{1}{3}\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$ 2) $\frac{1}{9}\begin{bmatrix} 8 & -4 & 1 \\ 1 & 4 & -8 \\ 4 & 7 & 4 \end{bmatrix}$
27.	Convert the following matrices in row Echelon Form: 1) $\begin{bmatrix} 3 & -2 & 0 & -1 \\ 0 & 2 & 2 & 1 \\ 1 & -2 & -3 & 2 \\ 0 & 1 & 2 & 1 \end{bmatrix}$ 2) $\begin{bmatrix} 0 & -1 & 2 & 3 \\ 2 & 3 & 4 & 5 \\ 1 & 3 & -1 & 2 \\ 3 & 2 & 4 & 1 \end{bmatrix}$
28.	Convert the following term into Reduced Row Echelon Form: 1) $\begin{bmatrix} 1 & 2 & -1 \\ 3 & 8 & 2 \\ 4 & 9 & -1 \end{bmatrix}$ 2) $\begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$

29.	Solve the following System of Equations by Gauss Elimination Method:
	1) $x + y + 2z = 9$
	     $2x + 4y - 3z = 1$
	     $3x + 6y - 5z = 0$
	
	2) $2x - 3y - z = 3$
	    $x + 2y - z = 4$
	    $5x - 4y - 3z = -2$

Unit-4	**Basic Concepts of Vectors and Vector Space**
[A]	**1 – Mark Questions**
1.	Find $3u - 6v$ if u= (3,-1,2) and v = (-4,1,8) ?
2.	Find $u.v$ if u = (1,2,3) and v = (-1,5,4) ?
3.	Find 'a' such that $\|(1, a, -3,2)\| = 5$
4.	State Pythagorean Theorem.
5.	Find the distance between = $(0,2,3)$ and $v = (1,2,-4)$?
6.	For which value of k , $u = (2,1,3)$ and $v = (1,7,k)$ are orthogonal ?
7.	Evaluate $\|u + v\|$, if u = (0,2,3,1) and v = (2,0,-1,-1)

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8.	If u and v are orthogonal vectors in R^n ,then prove that $\|u + v\|^2 = \|u\|^2 + \|v\|^2$
9.	Find the Cosine of the angle θ between the vectors u = (4,3,1,-2) and v = (-2,1,2,3) ?
10.	Verify Cauchy -Schwarz inequality for u = (-4,2,1) and V = (8,-4,-2)
[B]	**3 – Marks Questions**
1.	Find a unit vector perpendicular to each of the vectors (3, 1, 2) and (2, -2, 4)
2.	Find the Cosine of the angle betweenu = (2, 3, 1) and v = (3, -2, 0)
3.	Determine whether the given vector u = (-1, 3, 2) and v = (4, 2, -1) are orthogonal or not.
4.	Find an equation of the plane passing thought the point (2, 2, 0) and perpendicular to vector n = (0, 0, 2)
5.	Find $d(u, v), d(v, u), \|v\|$ for u = (1, 3, 0) and v = (1, 5, -7)
6.	Prove that $u + 0 = u$ for vector u in Rn
[C]	**5 – Marks Questions**
1.	Verify that the Cauchy-Schwarz inequality holds. $u = (3,2), v = (4,-1)$
2.	Verify Pythagorean theorem for u = (1,0) and v= (0, 2)
3.	Find the Cosine of the angle between u = (0, 0,1) and v = (2, 2 ,2)
4.	Verify Cauchy-Schwarz Inequality for u = (2, 4, 6) and v = (1 -1, -1)
5.	Prove that $(a + b)u = au + bu$ for vector u and scalars a, b in Rn
6.	Prove that $u \times v = -(v \times u)$ for vectors u , v in Rn
7.	Find the Cosine of the angle between u = (2, 3) and v = (5, -7)
8.	Find the Cosine of the angle between u = (1, -5, 4) and v = (3, 3, 3)
9.	Prove that $d(u, v) = 0$ iff $u = v$ for vectors in Rn
10.	Prove that $1. u = u$ for vector u in Rn
11.	Find an equation of the plane passing thought the point (3, 1,-7) and perpendicular to vector n = (4, 2, -5)
12.	Find $d(u, v), d(v, u), \|v\|$ for u = (1, 3, 0) and v = (1, 5, -7)
13.	Prove that u+0=u for vector u in Rn
14.	Find an equation of the plane passing thought the point (2, 2, 0) and perpendicular to vector n = (0, 0, 2)
15.	Does the vectors u = (6, 2, 2) , v = (2, 2, -2) and w = (1, 0, 1) with same initial point lies in the same plane?
16.	Find an equation of the plane passing thought the point (3, 1,-7) and perpendicular to vector n = (4, 2, -5)