**Ai Course Contents Notes Personal**

**Linear Agebra**

Vectors -   
 a vectors is a mathematical object that represents both magnitude and direction .  
 it can be visualized as arrow in space.  
Magnitude : this is the length of the vector , representing its size or intensity.  
Direction : This is the orientation of arrow in space pointing from tail to head.  
  
Types of vectors :  
1) Row vector –

This vector written horizontally : [1,2,3]

2) Column Vector –

This vector is written vertically e.g . [1;2;3]

3) Unit vector –

A vector with the magnitude 1 used to represent directions   
 standard unit vector in coordinate system are denoted as i,j,k for x,y,x axes respectively.

**Operations on Vectors:**

Addition:

Vectors can be added component-wise.

Subtraction:

Vectors can be subtracted component-wise.

Scalar Multiplication:

A vector can be multiplied by a scalar (a number), which scales its magnitude but does not change its direction.

Dot Product:

The dot product of two vectors gives a scalar value, representing the projection of one vector onto the other.

Cross Product (in 3D):

The cross product of two vectors gives another vector perpendicular to both, representing the area of the parallelogram they define.

**Applications of Vectors:**

Vectors have numerous applications in various fields, including:

Physics:

Representing force, velocity, acceleration, and momentum.

Engineering:

Describing displacements, velocities, and forces in structural analysis.

Computer Graphics:

Representing positions, directions, and colors.

Machine Learning:

Used in algorithms like principal component analysis and support vector machines.

**1.2 Scalers -** A scalar in linear algebra is a single, numerical value. It's a quantity that can be represented by a single number, such as 2, -5, or 3.4. Unlike vectors, which have both magnitude and direction, scalars have only magnitude.

**Examples of Scalars:**

Temperature: 25 degrees Celsius

Mass: 5 kilograms

Time: 3 hours

Speed: 60 miles per hour

**Key Points About Scalars:**

Numerical Value:

Scalars are always represented by a single number.

No Direction:

They do not have a direction associated with them.

Operations:

Scalars can be added, subtracted, multiplied, and divided with other scalars.

Vector Operations:

Scalars can also be multiplied by vectors, resulting in a scaled vector with the same direction but a different magnitude.

**Scaler Addition :**

Scalar addition involves adding a scalar value to each component of a vector.

Example: Consider the vector v = [1, 2, 3] and the scalar s = 4. Scalar addition would result in:

v + s = [1 + 4, 2 + 4, 3 + 4] = [5, 6, 7]

**Scalar Multiplication:**

Scalar multiplication involves multiplying each component of a vector by a scalar value.

Example: Using the same vector v and scalar s as before:

s \* v = 4 \* [1, 2, 3] = [4 \* 1, 4 \* 2, 4 \* 3] = [4, 8, 12]