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Improvement in the Engineering Properties of Soil using Plastic Waste

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Abstract: ***According to central board of India, Our country generates 25,940 tons plastic per day which is close to the weight of 9000 Asians elephant, 86 bowing and 747 jets. Out of which 10376 per day is uncollected plastic. The gathering of plastic items in the condition that unfavorably influences Wildlife, wild environment or people. Plastic that acts as pollutants However, it is slow to degrade.***
Plastic pollution can unfavorably affect lands, water-ways and oceans. Living organism particularly marine animals can also be affected through entanglement, direct ingestion of plastic waste . The productions of plastic have been increasing day by day and it is to big question have arisen, how can be disposed plastic waste.
This research involves an investigation on the effects of plastic waste on some geotechnical properties of locally available soil. The investigation includes evaluation of properties such as compaction, Atterberg limits and strength of soil by performing triaxial test, CBR test, permeability test. These test are perform on the untreated soil and soil treated with plastic waste content in the form of random size and perforated strips with percentage of 0.1%,0.3%, 0.5%,0.7%, and !% By this entire test we will find the optimum percentage of plastic strips in soil
Keywords: Engineering properties, locally available soil, random size and perforated strips.

I. INTRODUCTION

Engineering structure such as building, road, dam, bridge railway etc. ultimately load of these structure is transfer to the soil through the foundation .And the bearing capacity of that soil should be such that it can take the load without shear failure and the bearing capacity of soil depend upon the various property of the soil such as void ratio, porosity, permeability, compressibility etc. And the improvement of this property of the soil is known as soil stabilization.

This can be done by either physically or chemically. physical process involve compaction and chemical process involve adding of suitable stabilizer like cement, calcium sulphet , calcium hydroxide and waste materials like fly ash, plastic, etc. the stabilization by the waste product such as plastic, fly ash and bamboo act having least cost as compare to stabilization with cement and lime. The main aim of soil stabilization increasing the contact between the soil particles. If the contact between the particles will be increasing then void ratio, porosity (water holding capacity) and permeability and compressibility of soil decreasing and strength of the soil will be improved. In fine grain soil stabilization can be done by reducing plasticity of the soil.

The other prime goal of soil adjustment is to enhance site materials to make a strong and solid sub-base and base courses and the soil for take caring the load which will come from the any engineering structure such as road, building, bridge and dam etc .Soil stabilization can also be done to eliminate certain undesirable property of the soil such as swelling and shrinkage, plasticity, difficulty in compaction etc.

This is new procedure of improving soil property can be successfully used to decrease the quantity of the wastage material, to produce helpful material from non-helpful waste materials. Problem of decomposition can be solve by using these concept , for example, polypro line strips , strips of plastic bottles and so forth is expanding step by step prompting different ecological concerns. In this manner the removal of the plastic squanders without causing any biological perils has become a genuine test. In this manner utilizing plastic containers as a dirt stabilizer is a practical use since there is shortage of acceptable quality soil for banks. In this research the soil stabilization is done by using the waste plastic strip. The study was done by conduct different test on the soil reinforced with layers of plastic polythene with soil and polythene can be use in the form of strips. The test can be performed at the different percentage having constant size of the strips and the test can also be done at the constant percentage of strips having different size of the strips..

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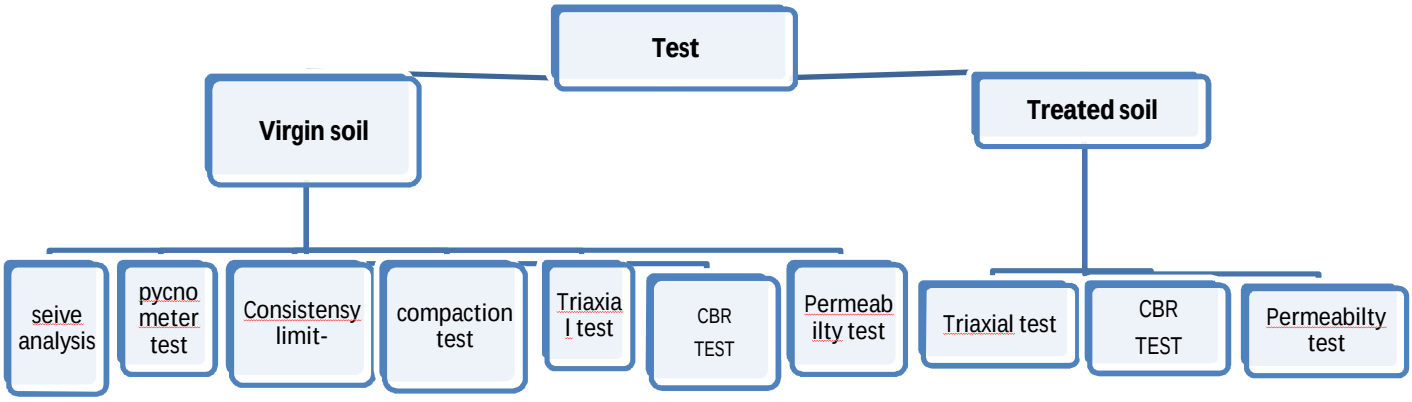
II. METHODOLOGY



III. MATERIAL USED

1) *Locally available Soil:* The soil sample taken for this study is obtained from AJAYPUR sikandar kampoo, it was taken from at a depth of 2.5 m and brought for the project work in the geotechnical lab in our college. Desirable test is to be performed on the soil sample in college lab with the collected soil sample and properties of the soil are determined. Before testing it is assured that the soil is free from any organic matter, stone pebbles etc.The soil is classified as medium compressibility silt

Properties	Soil
Liquid limit (%)	38.5
Plastic limit (%)	29
Plasticity index (%)	9.5
Specific gravity	2.72
Optimum moisture content (%)	12
Maximum dry density (KN/m^3)	18.73
CBR value (%)	1.9
COHESSION (kg/cm^2)	0.6
ANGLE INTERNAL FRICTION	23.5°
SHEAR Strength (kg/cm^2)	3.01
Coefficient of permeability (cm/s)	1.112×10−7
Grain size distribution	
Particle size <0.075mm (%)	84.8

Table1. Properties of soil

2) *Plastic Fibre:* The majority of plastic waste comes from packaging and containers (e.g. shipping materials, shampoo bottles, beverage bottles etc.) Once we have consumed whatever was contained in that plastic, it becomes “waste.” As we continue to utilize plastic products, we continue to generate more plastic waste. Polypropylene Plastic Fiber (PPF): It is a mixture of plastic fiber collected from used chairs and bottles. Fiber strips which having following property-

PARAMETER	STANDARD VALUE
Unit weight	0.91 g/cm3
Burning point	590˚ c
Modulus of elasticity	1800 N/mm2
Fiber Type	Single
Thickness	50µ
Length	60mm
Width	20mm

TABLE-2

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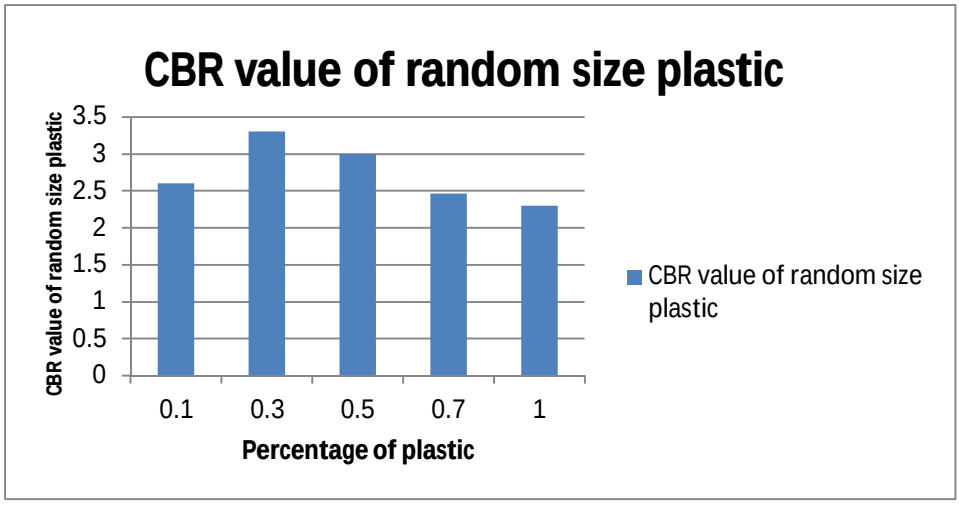
IV. LABORATORY INVESTIGATION AND RESULT

In this research work experiments to determine the physical and mechanical properties of soil were conducted. According to Indian Standard Classification System (ISCS) the soil is classified. Liquid limit, plastic limit, plasticity index, specific gravity, standard proctor compaction, tri-axial test, permeability test, California bearing ratio tests were conducted on soil sample. Result of soil sample after replacement of random size plastic and perforated plastic with percentage of 0.1% 0.3% 0.5%, 0.7%, and 1%

California Bearing Ratio Test

Weight of the soil	Percentage of plastic	CBR value of random size plastic	Percentage increase
5.5 kg	0.1	2.6	36.84
5.5kg	0.3	3.3	73.68
5.5kg	0.5	3	57.9
5.5 kg	0.7	2.46	21.6
5.5kg	1	2.3	21.05

Table-3 Treated with Random Size Plastic Strips



Weight of soil sample	Percentage of plastic	CBR Value	Percentage increase
5.5kg	0.1	2.62	37.89
5.5kg	0.3	3.42	80
5.5kg	0.5	3.2	68.42
5.5kg	0.7	3	57.89

Table-4 Treated with Perforated Plastic Strips

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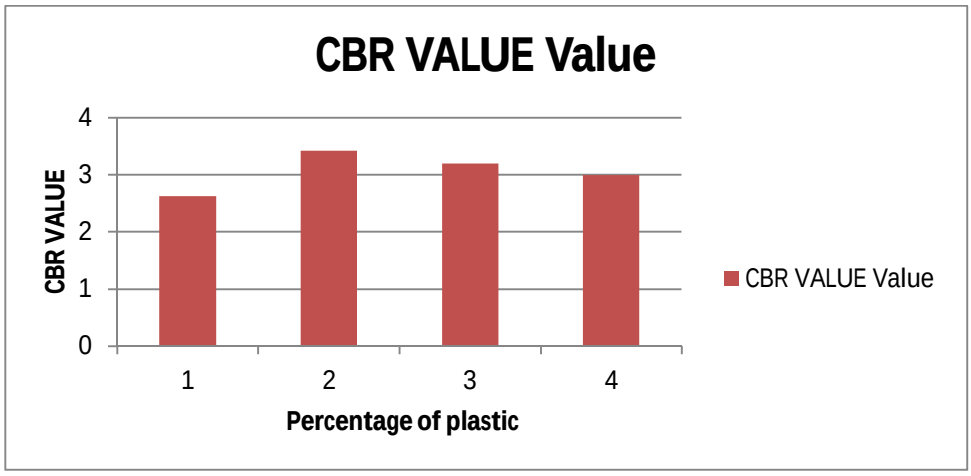
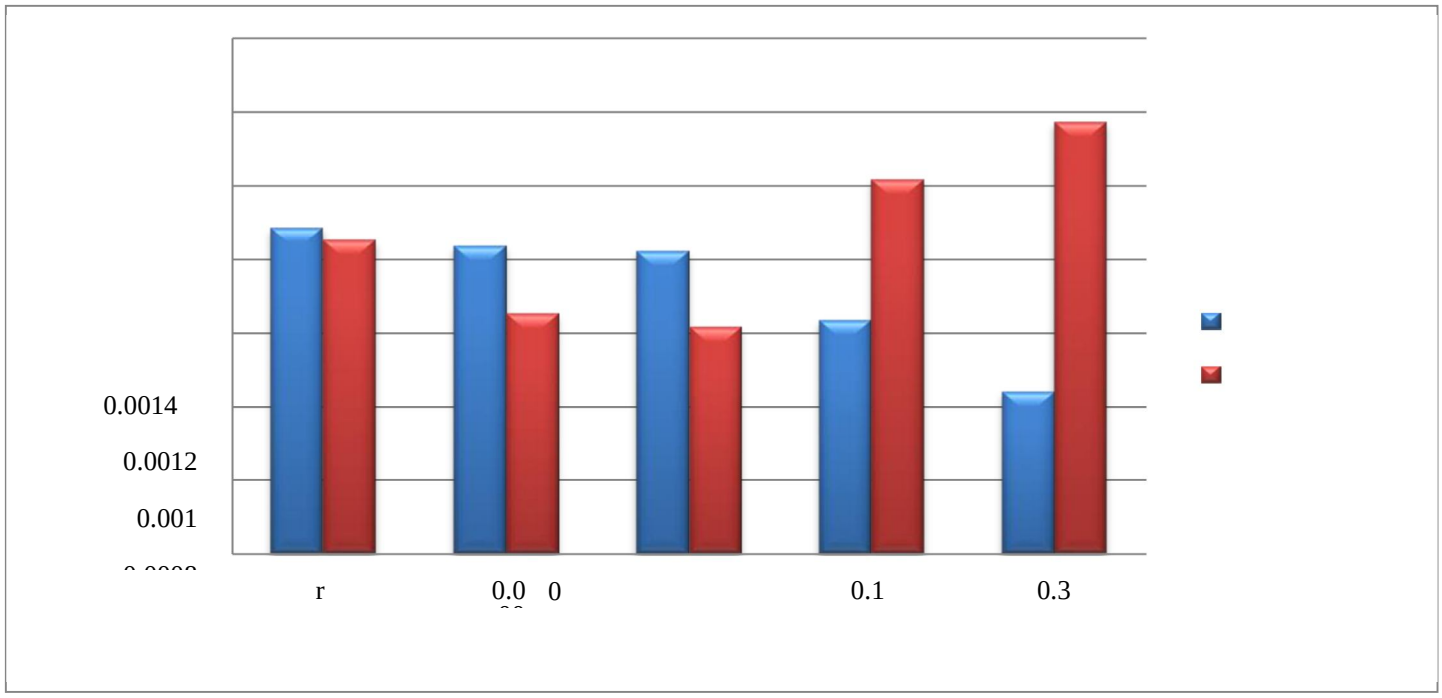


Permeability Test

Soil + Plastic Percent	Permeability Value(mm/s) (Random size plastic)	Permeability value(mm/sec) (perforated plastic)
Soil+0.1%Plastic	0.000834	0.000652
Soil+0.3%Plastic	0.000820	0.000614
Soil+0.5% Plastic	0.000633	0.001016
Soil+1% Plastic	0.000439	_
Soil+1.5% Plastic	0.000269	_

TABLE-5



TRI-AXIAL TEST

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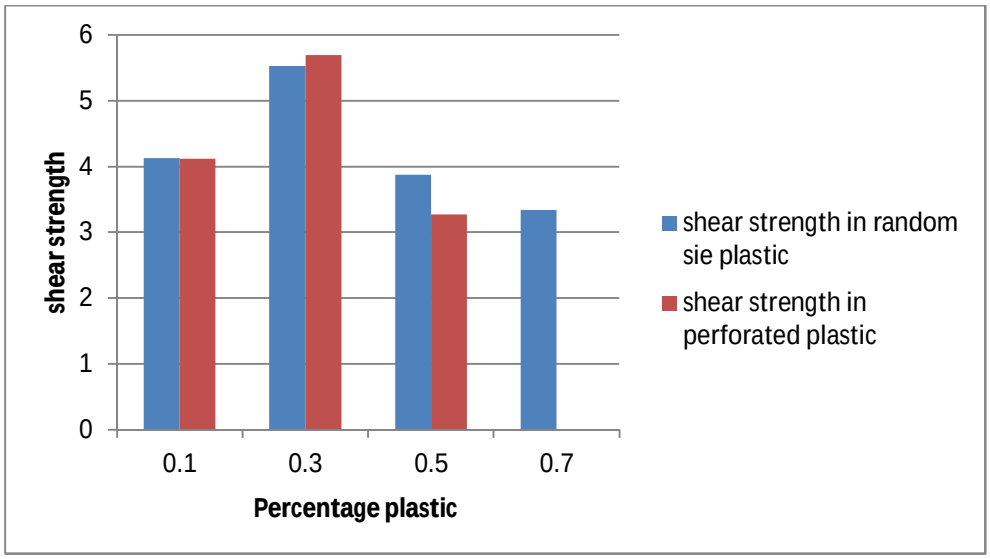
PLASTIC IN PERCENT	SAMPLE FOR UNTREAD SOIL	CELL PRESSURE kg/cm² s3	AXIAL STRESS (kg/cm ²) s1	COHESSION (kg/cm²)	ANGLE INTERNAL FRICTION	SHEAR Strength (kg/cm²)t	% variation in shear strength
0.1%	1	1	4.72	0 .42	32°	4.13	33.8
	2	2	7.62				
0.3%	1	1	5.25	1.31	20°	5.53	73.8
	2	2	7.78				
0.5%	1	1	4.176	0.49	27°	3.87	8.0
	2	2	7.20				
0.7%	1	1	4.00	0.72	25°	3.34	.99
	2	2	6,41				

Table-6 Treated with Random Size Plastic Strips

PLASTIC IN PERCENT	SAMPLE FOR UNTREAD SOIL	CELL PRESSURE kg/cm² s3	AXIAL STRESS (kg/cm²) s1	COHESSION (kg/cm²)	ANGLE INTERNAL FRICTION	SHEAR Strength (kg/cm²)t	% variation in shear strength
0.1%	1	1	4.98	0.6	30°	4.12	36.8
	2	2	7.89				
0.3%	1	1	6.2	0.7	38°	5.69	89
	2	2	10.6				
0.5%	1	1	4.46	0.68	25°	3.27	8.63
	2	2	7.09				

Table-6treated With Perforated Plastic Strips



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V. CONCLUSION

In this study, the soil is mixed with random size plastic strips and perforated plastic strips of different percentages (0.1%, 0.3%, 0.5%, 0.7% and 1%) and tests are performed which include CBR permeability test and tri-axial test results are conclude as:

A. Permeability of soil sample is decreasing when the amount of plastic content is increasing at the limit. Perforated plastic strips are more efficient than random size plastic strips to decrease the permeability of soil,0.3% plastic content in both cases of strip's type is adoptable to treat the of soil.

B. The graph shows maximum value of CBR value of soil sample treated with random size strips is 3.3% at 0.3% plastic content. And at 0.3% plastic content value of CBR is3.42%. Perforated plastic strips are more efficient than random size plastic strips. If we treat the soil sample with perforated plastic strips this give better result. 0.3% plastic content in both cases of plastic strips is more efficient value for treating the soil sample.

C. Maximum shear strength percentage increasing at 0.3% plastic on both cases .Shear strength value is increasing at the limit of 0.3% then it decreases.

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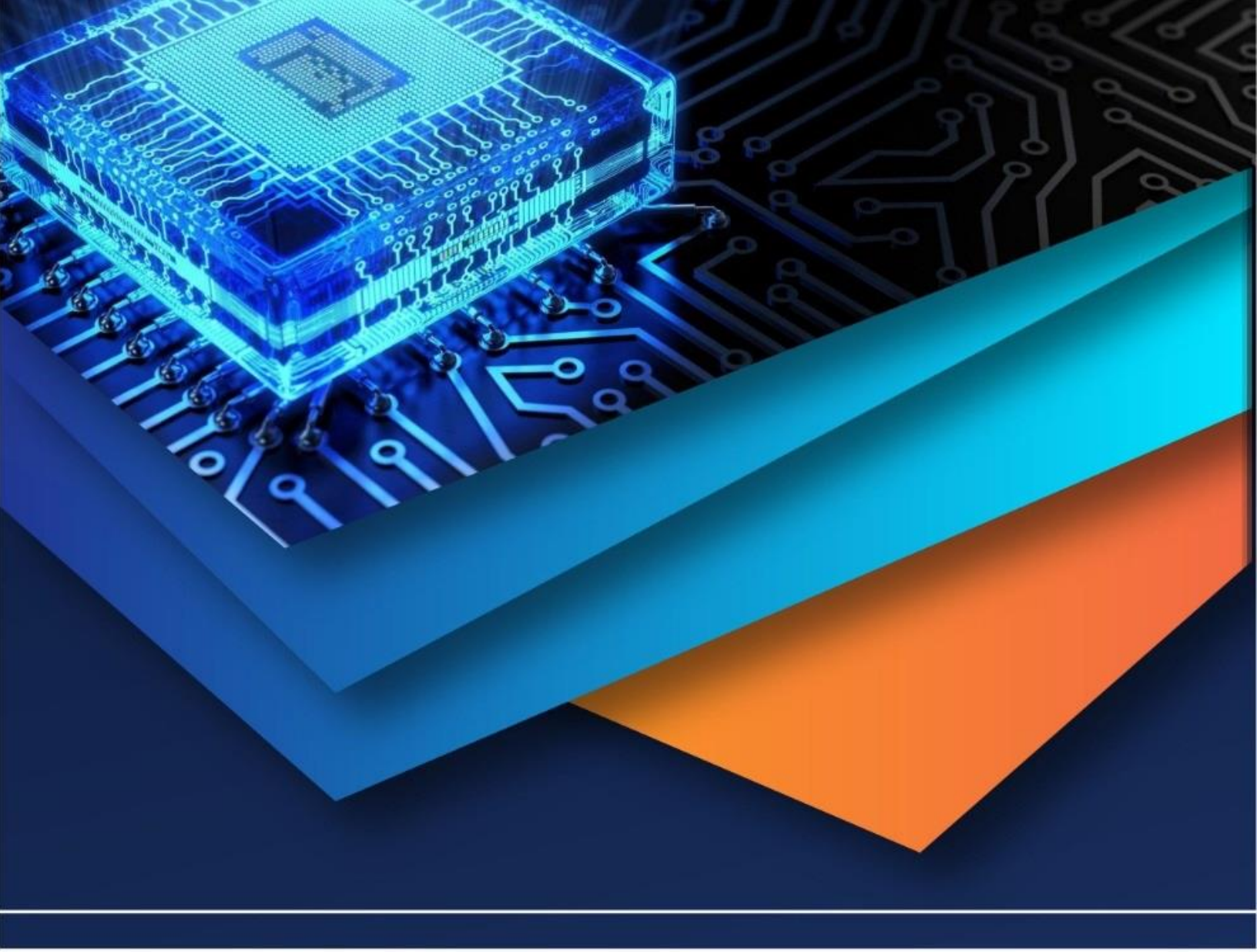

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