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Seismic Analysis of RC Building Frame Structure

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Abstract: ***In this Research project, we analyzed the G+13, RC Building Frame structure with seismic Zone II and Zone III with considered soft, Medium and Hard soils by using Linear Static method in a Staad Pro V8i civil software as per IS 1893 (Part I). In this work we adopted various parameters like plan of building 24.02mX24.02m symmetrical along to X and Z direction respectively, Damping ratio 5 percent, importance factor 1.5 for important structure, Special RC Moment Resisting Frame as 5. The comparative analysis of this frame structure in the term of maximum displacement, maximum shear forces, maximum bending moment, maximum storey-wise displacement. Results found that, the seismic zone II and III with all type of soil conditions, the support reaction and also axial forces are same. The results in the terms of bending moment, shear force and node displacement, maximum as zone III in soft soil while minimum in Zone II in hard soil, it means that if zone varies lower to higher with hard soil to soft soil, the action of seismic effect is varies. And also observed that story wise displacement, if the number of stories increased , the displacement is also increased.***

Keywords: Staad Pro, Seismic Zone, Soil Condition, Seismic analysis etc.

I. INTRODUCTION

Today's time Structural Engineers appreciable challenge in today's structure is constructing earthquake resistant structure. The challenge further increases due to increased eye pleasant high rise structures with architectural trouble.

These architecturally pleasant structures with formation deformity, when subjected to destructive earthquake are a matter of concern. The bearing of a building during earthquakes depends reproving on its overall shape, size and geometry, in addition to how the seismic forces are carried to the ground. Sahyadri Engineering college building is used for the case study. A detailed study of this building for gravity loads and seismic loads are investigation and outcome like shear, moment carrying capacity and reinforcements required are differentiate.

For the gravity load case a suitable method of retrofitting is approved if it is below production quantity. With better understanding of earthquake demand on structures and with our current experiences with large seismic zone near city centers, the need of earthquake retrofitting is well allow.

B. Gireesh Babu (2017) {1}, studied that the Conventional Concrete Design and seismic analysis and design of G+7 storey Residential building in seismic zone II by using Staad pro Software. He analyzed the 2-D frame and the different parameters used like RF =3 for OMRF and importance factor =1. He observed that the quantity of steel increased in the conventional concrete design resulting in the ground floor to higher floors as compared to Staad Pro.

Vikash Mehta, KanchanRana April-Sept. 2017 {2}, studied that the seismic analysis of Multi-storey Regular Building (G+25) in Seismic Zone V by using Time History method and Response Spectrum Method in a Staad Pro Software as per IS 1893 (Part-I) 2002. He found that the storey drift slightly decreased while increased storey displacement with increased the storey heights.

Dr. Syed Aqueel Ahmad, Rajiv Banarjee et.al. (2018) {3), studied that Seismic Analysis &Desiging of G+10 Storied Building by Strut &Staad pro Software with different loading conditions and compared the results. He observed that shear wall should be placed at a point by coinciding the center of gravity and centroid of the building.

A Primary Objective of this research works

1) To performed the Seismic Analysis of RC building framed structure by using Staad Prof. software.
2) To comparative Study of Seismic Analysis of Building Frame Structure considered with different zone.
3) To Comparative Analysis of Building frame with different soil conditions**.**

II. MATHEDOLOGY

In the recent time, Civil & Structural software's analysis is more effectively used in analysis and design of different civil engineering structures. In this work, we using Staad pro software and analyzed the structure as per IS 1893:2002. The following steps are adopted:

1) *Step-1* Modeling of building frame in Node & Transitional repeat with different type of soils, symmetrical (24.02mX24.02m)G+13 story of 3D frame. Fig. 2.1

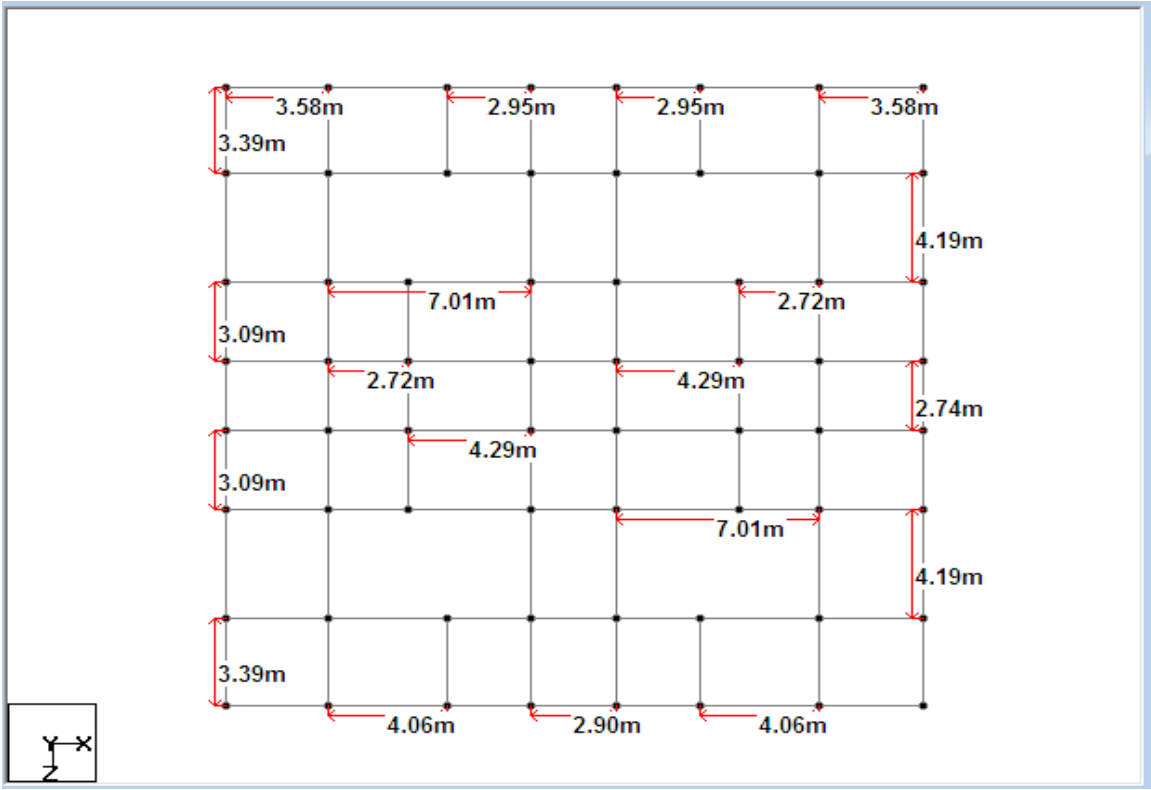

Fig. 2.1 Plan of Building

2) *Step-2* Selection of Building Geometry: Plan of Building 24.02mX24.02m , Size of Columns 450mmX450mm, Size of Beam 230mm X 450mm, Thickness of Slab 150mm; Height of each floor 3.0m, Unit weight of RCC 25KN/m^3, Unit weight of bricks 20KN/m^3 and Fixed supports.
3) *Step-3* selection of Seismic Zone and soil conditions As per IS Code.
4) *Step-4* Load combinations.

Load case no.	Load cases
1	DL
2	LL
3	EQ,X+
4	EQ,X-
5	E.Q,Z+
6	E.Q,Z-
7	1.5(DL+LL)
8	1.5(DL+E.Q.,X)
9	1.5(DL-E.Q.,X)
10	1.5(DL+E.Q.,Z)
11	1.5 (DL-E.Q.,Z)
12	1.2(DL+LL+E.Q.,X)
13	1.2 (D.L+L.L-E.Q.,X)
14	1.2 (DL+LL+E.Q.,Z)
15	1.2 (DL+LL-E.Q.,Z)

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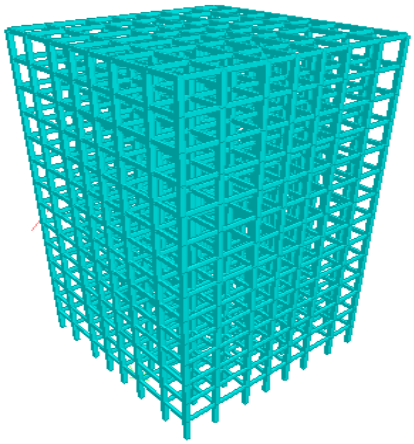
5) *Step-5* Designing of building frames using STAAD.Pro v8i software in 3D rendered view.



6) *Step-6* Analysis considering different types of soil condition providing different seismic zones.
7) *Step-7* Comparative the results in the term of storey-wise displacement, shear force, bending moment, node displacement etc.

A. Flow Chart Diagram

For this Project Work, Flow chart of proposed method of this analysis.

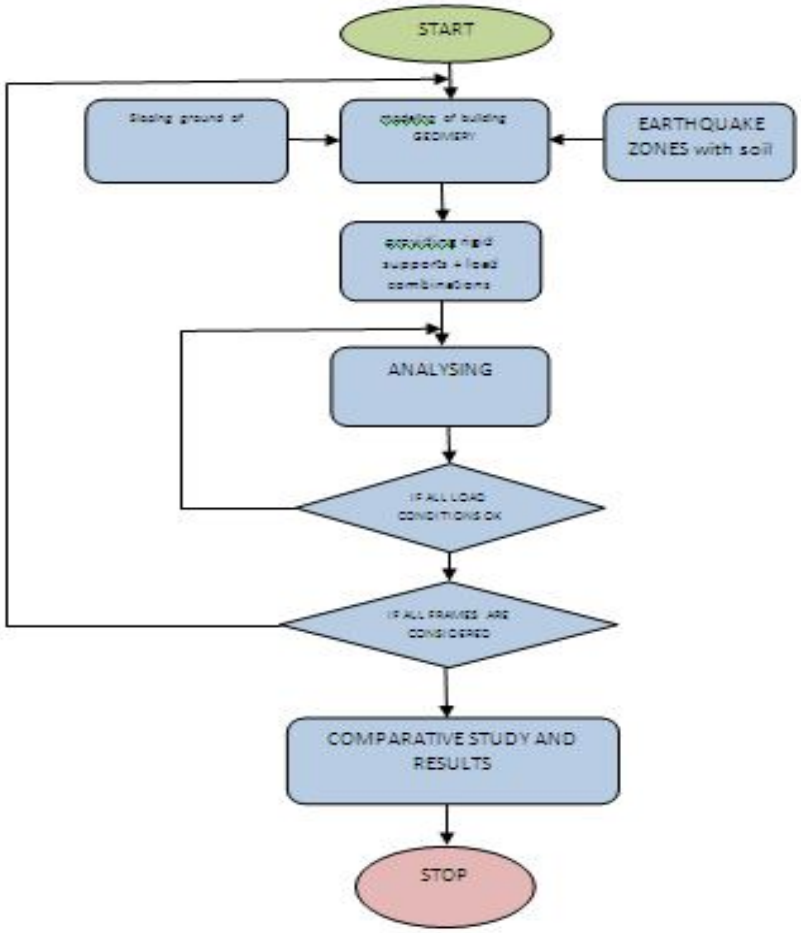


Fig. Flow Chart Diagram

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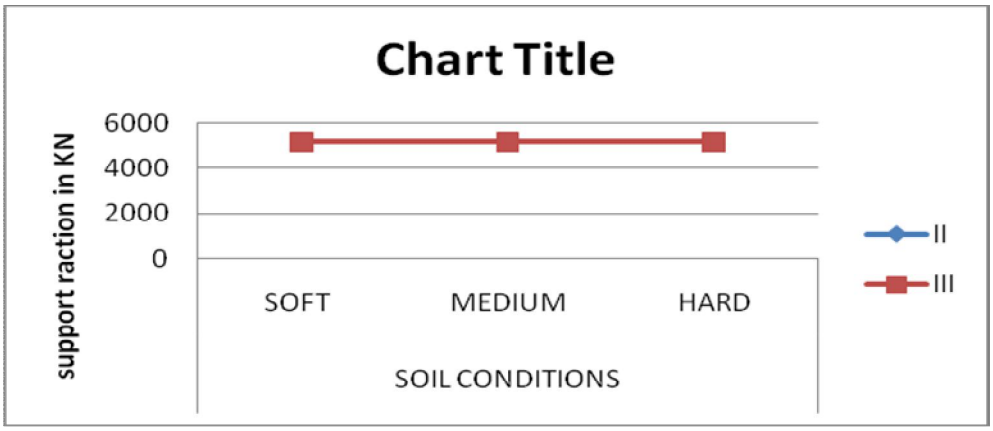
III.RESULTS AND ANALYSIS

A. *Support Reaction*

Maximum support reaction in kn

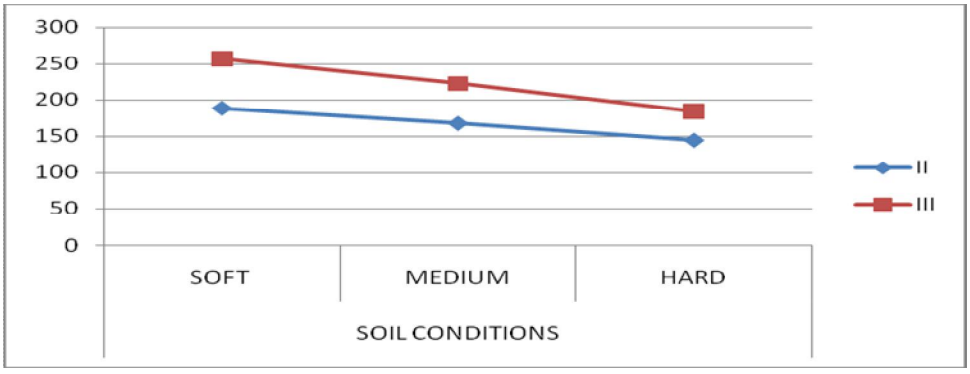
ZONE	SOIL CONDITIONS		
	SOFT	**MEDIUM**	**HARD**
II	5177.04	5177.04	5177.04
III	5177.04	5177.04	5177.04



B. *Maximum Bending Moment*

Maximum Bending Moment IN KN-m

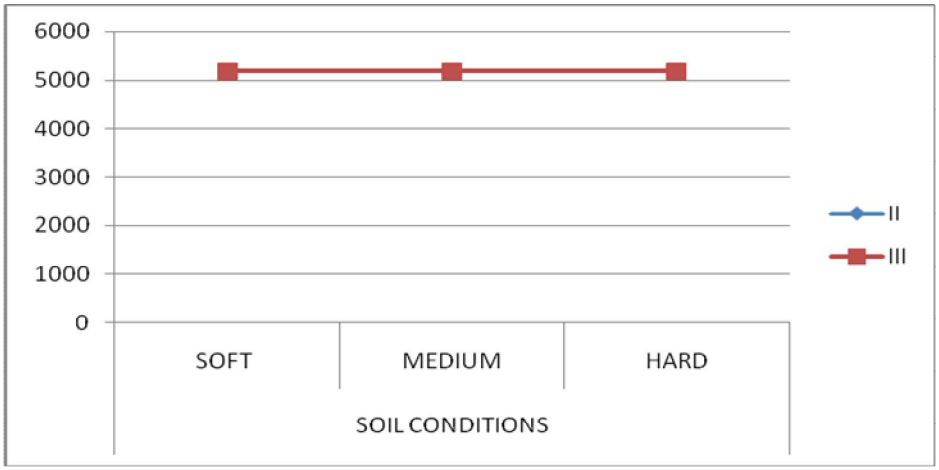
ZONE	SOIL CONDITIONS		
	SOFT	MEDIUM	HARD
II	188.369	167.615	144.634
III	257.581	222.921	183.667



C. *Axial Forces*

MAXIMUM AXIAL FORCE IN KN

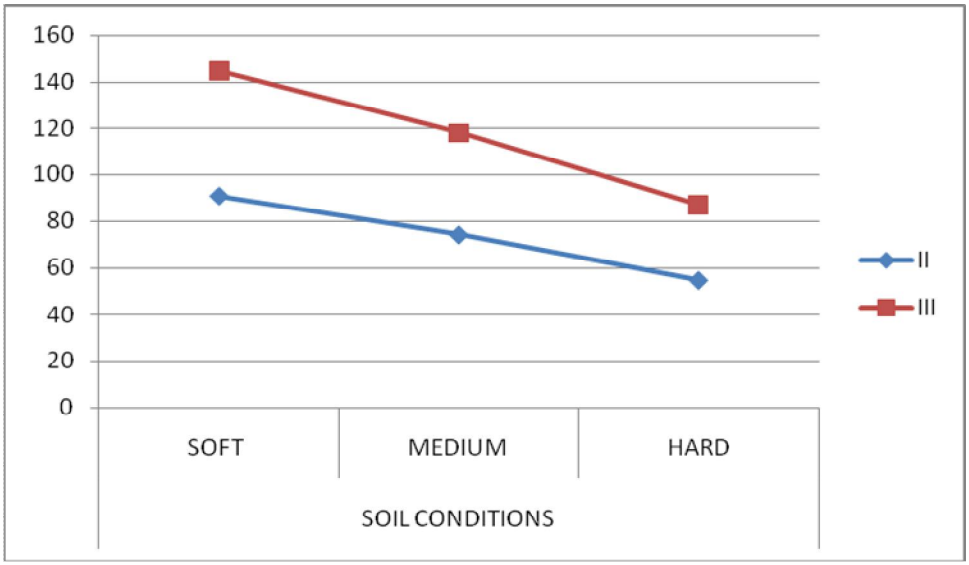
ZONE	SOIL CONDITIONS		
	SOFT	MEDIUM	HARD
II	5177.04	5177.04	5177.04
III	5177.04	5177.04	5177.04



D. Maximum Displacement

Maximum Displacement in mm

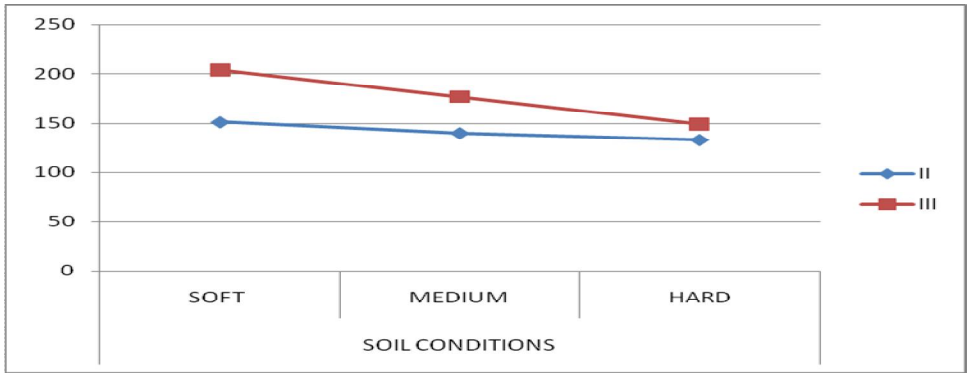
ZONE	SOIL CONDITIONS		
	SOFT	MEDIUM	HARD
II	90.622	73.844	54.361
III	144.852	118.008	86.834



E. Shear Forces

Maximum Shear Force in KN

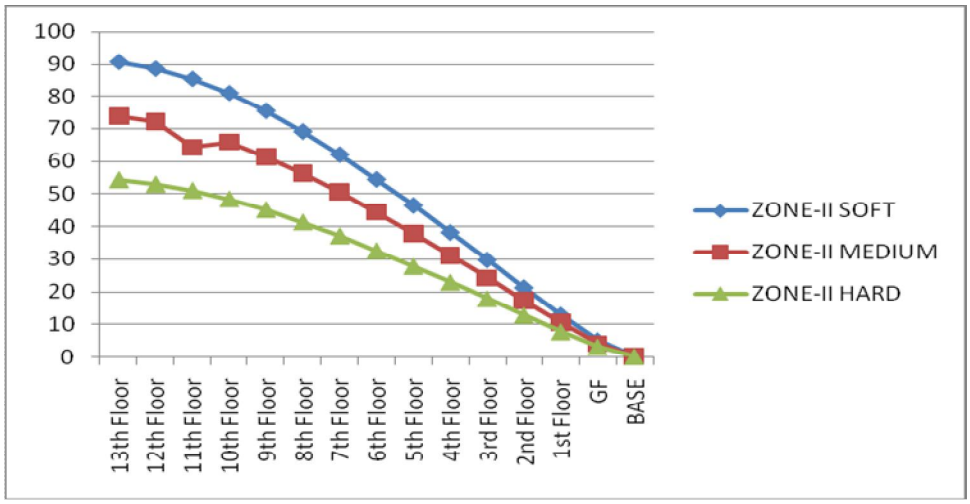
ZONE	SOIL CONDITIONS		
	SOFT	MEDIUM	HARD
II	151.269	140.138	133.275
III	204.076	176.714	148.738



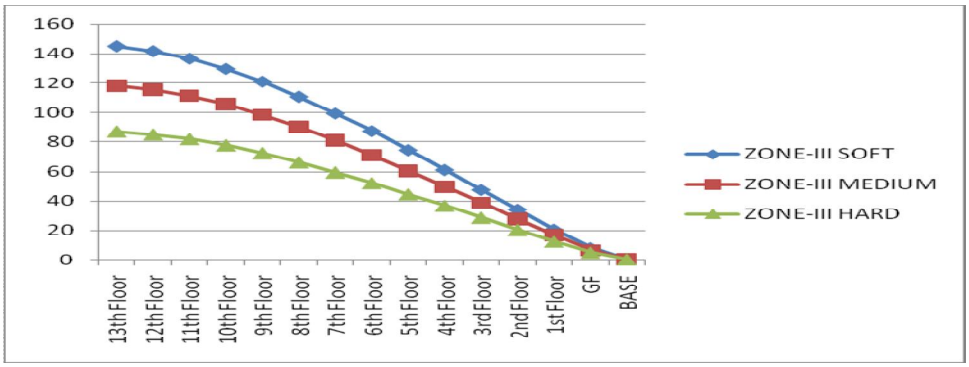
F. Story-wise Node Displacement

Story-Wise Node Displacement in Zone II (mm)

STOREY	ZONE-II		
	SOFT	MEDIUM	HARD
13th Floor	90.622	73.844	54.361
12th Floor	88.498	72.074	53.001
11th Floor	85.328	64.251	51.097
10th Floor	80.903	65.886	48.446
9th Floor	75.407	61.411	45.156
8th Floor	69.033	56.22	41.34
7th Floor	61.971	50.469	37.111
6th Floor	54.366	44.276	32.558
5th Floor	46.363	37.759	27.767
4th Floor	38.092	31.024	22.815
3rd Floor	29.664	24.16	17.769
2nd Floor	21.181	17.252	12.689
1st Floor	12.777	10.408	7.658
GF	4.907	3.999	2.948
BASE	0	0	0



STOREY	ZONE-III		
	SOFT	MEDIUM	HARD
13th Floor	144.852	118.008	86.834
12th Floor	141.583	115.305	84.789
11th Floor	136.522	111.181	81.752
10th Floor	129.442	105.415	77.512
9th Floor	120.649	98.254	72.247
8th Floor	110.45	89.948	66.14
7th Floor	99.149	80.745	59.374
6th Floor	86.98	70.835	52.087
5th Floor	74.175	60.408	44.421
4th Floor	60.94	49.63	36.496
3rd Floor	47.454	38.648	28.421
2nd Floor	33.88	27.594	20.294
1st Floor	20.434	16.644	12.242
GF	7.85	6.393	4.702
BASE	0	0	0



IV. CONCLUSIONS

We found that, the seismic zone II and III with all type of soil conditions, the support reaction and also axial forces are same. The results in the terms of bending moment, shear force and node displacement, maximum as zone III in soft soil while minimum in Zone II in hard soil, it means that if zone varies lower to higher with hard soil to soft soil, the action of seismic effect is varies. And also observed that story wise displacement, if the number of stories increased , the displacement is also increased.

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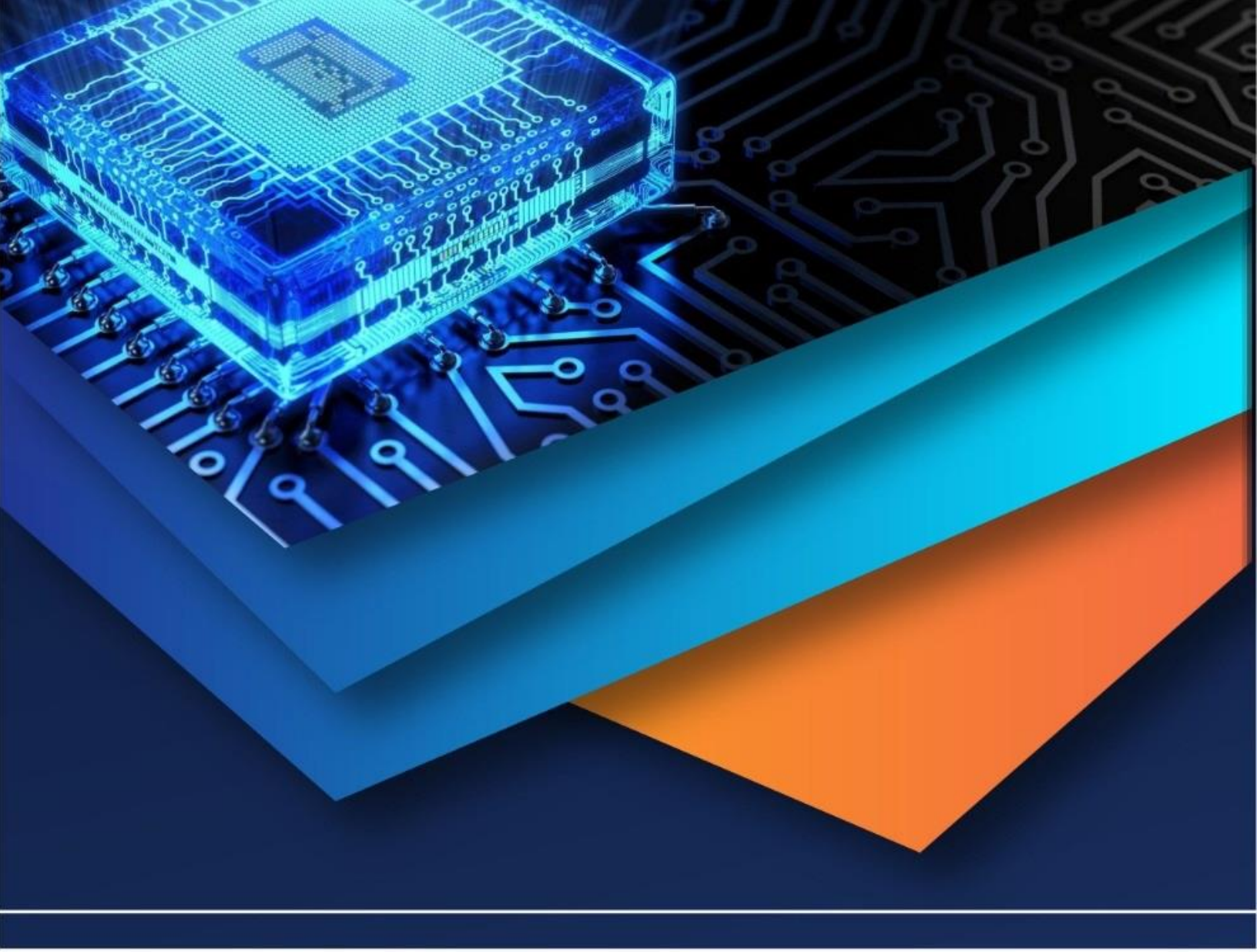

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