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Investigation and Approach of G+8 Building with Contrast the Results by using Staad.Pro and Etabs

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Abstract: Structural analysis (calculating load coming on every member) is one of the most difficult and time consuming process. One single error can lead to life and money loss. STAAD. Pro and ETABS helps in analysis and designing (choosing size of member for coming load) of structures with very less time. Etabs is good for the designing a reinforced concrete structure. The user interface is easy and the analysis values of RC structures are better and we get economical steel data from etabs. Staad Pro is good for the analysis of steel structures frames as the codes and user interface is better integrated in staad pro. In this project we analyzing the G+8 building for finding the shear forces, Base shear, Bending moments, deflection and reinforcement. This project mainly deals with the comparative analysis of the results obtained by designing of a regular and a plan irregular (as per IS 1893) multi storey building structure designed separately using STAAD. Pro and Etabs softwares.
Keywords: Sructural analysis, Regular and irregular, frame work, staad.pro, etabs.

I. INTRODUCTION

During an earthquake, failure of structure starts at elements of weak point. This weakness develops because of stoppage in mass, strength and also geometry of structure. The structures having this deduction are described as uneven frameworks. Uneven structures add a large portion of city framework. Upright irregularities are just one of the substantial variables of failings of structures throughout earthquakes. For instance a structure with soft floor was among one of the most significant frameworks which collapsed. So, the result of up and down abnormalities in the seismic effectiveness of structures winds up being really essential. Height-wise adjustments in stiffness in addition to mass render the vibrant attributes of these structures various from the regular framework. IS 1893 definition of Backwards and forwards unequal frame work. The abnormality in the structure frameworks could be due to irregular blood circulations in their mass, toughness along with tightness along the altitude of framework. When such frameworks are created in high seismic areas, the analysis and additionally design winds up being far more challenging. There are 2 types of irregularities.

1) Plan irregularities
2) Vertical Irregularities

A. Plan Irregularities

To offer first rate all-natural light and air float and to have an exceptional out of doors view from all the spaces, the designers set up very complex strategy shapes with re-entrant corners, floor slab reduce-outs, and additionally asymmetry These abnormalities are desirable to confined degree, however name for specific factor to remember in evaluation in addition to format, that's generally in no way made. In case of RC systems, now not just the method should be of ordinary shape, the arrangement of lateral load withstanding vertical additives ought to additionally be symmetrical.

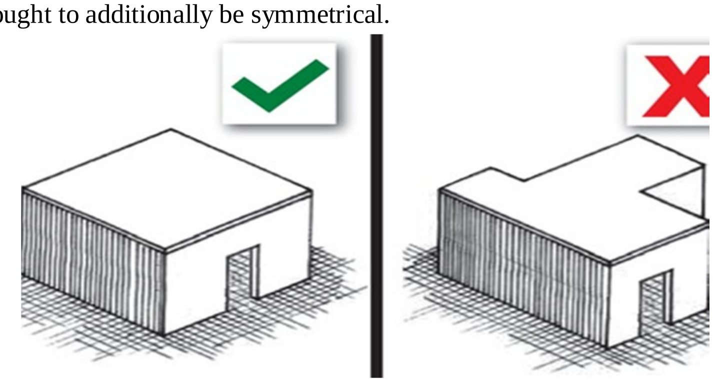

Figure1.1: Plan irregularities

B. Vertical Irregularities

Vertical Abnormalities are especially of five kinds-.

1) *Stiffness Irregularity:* Soft Storey-A tender ground is one in which the lateral pressure is much less than 70 percent of the storey above or less than eighty percentage of the commonplace side stiffness of the three flooring above.
2) *Stiffness Abnormality:* Extreme Soft Storey-An immoderate smooth storey is one wherein the lateral pressure is much less than 60 percent of that in the floor above or much less than 70 percentage of the typical tightness of the 3 flooring over.
3) Mass irregularities
4) Vertical geometric irregularity

Figure1.2: Mass irregularities

II. OBJECTIVE OF THE STUDY

The following objectives are set in this study:

A. To accomplish modeling as well as assessment of G+ 8 R.C. framed frameworks utilizing STAAD-PRO & ETABS.
B. To Design ass per IS-456 & IS-1893:2002, a regular and irregular multi-storey structure.
C. To calculate shear forces, bending moments and reinforcing details for the buildings structural components (beams and columns) and compare the results.
D. To determine the economic section of the G+8 structure with both software.

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III. MODELLING OF G+8 STRUCTURE

In the recent time, Civil and Structural softwares analysis is more affectively used in analysis and design of different civil engineering. In this work we are using Staad Pro and Etabs softwares and analyzed structures as per IS 1893:2002. The following steps are adopted:

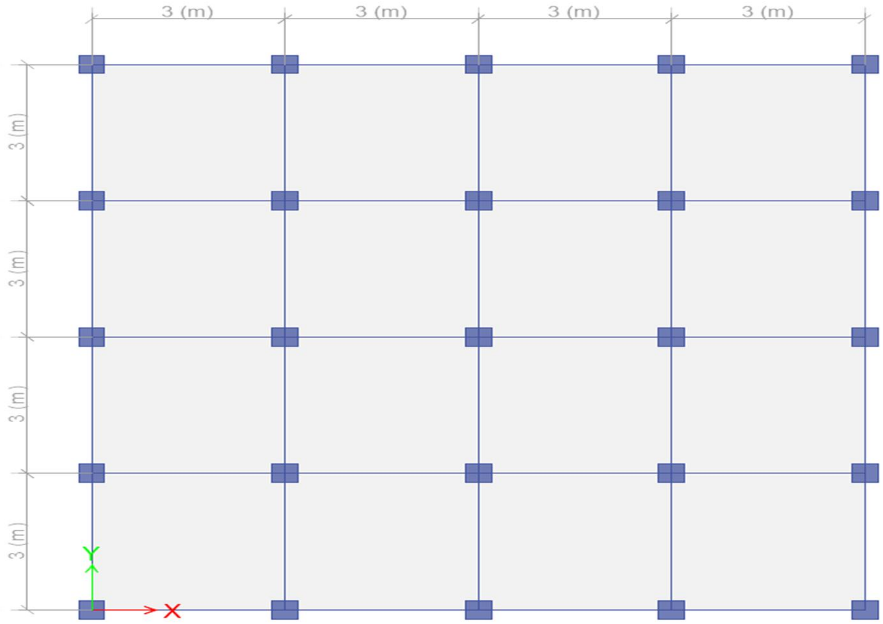
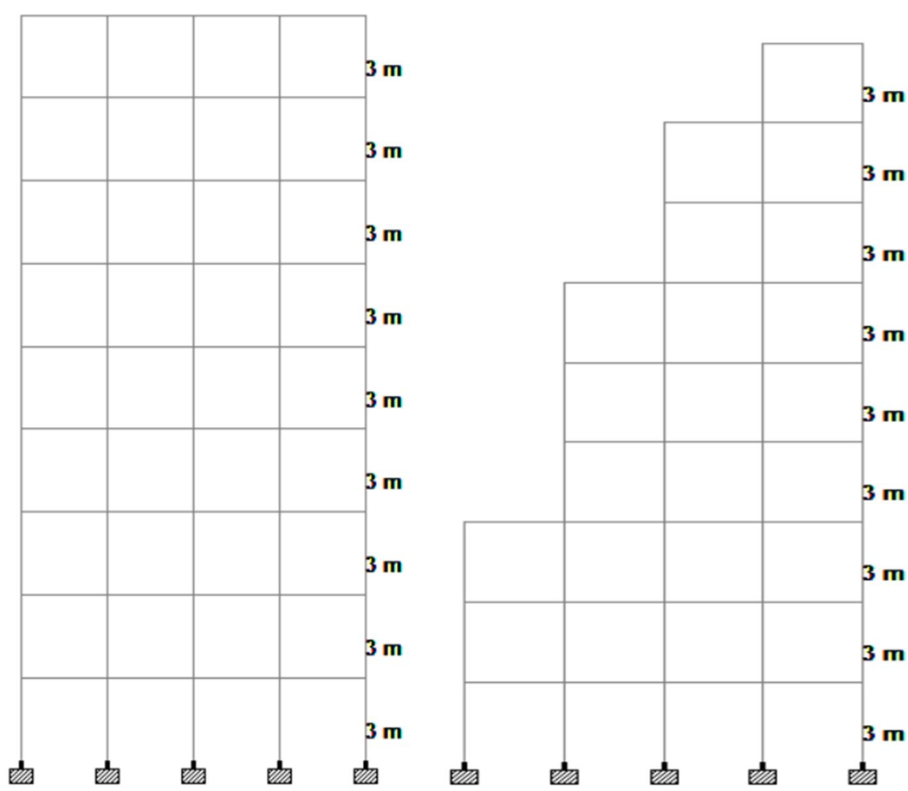


Figure2.1: Plan of G+8 Building



Regular Structure Irregular Structure

Figure2.2: Elevation of 2-Models

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A. Preliminary Data
Type of frame :Ordinary RC moment resisting frame fixed at the base, Seismic zone :II , Number of storeys:9, Floor height:3m , Plinth height:1.5m, Depth of Slab:125 mm, Spacing between frames:3m along both directions, Live load on floor level:3 KN/m^2, Live load on roof level:1.5 KN/m^2, Floor finish:1.0 KN/m^2, Terrace water proofing:1.5 KN/m^2, Thickness of infill wall :230mm (Exterior walls),Thickness of infill wall:150mm (Interior walls), Density of concrete:25 KN/m^2, Density of infill:20 KN/m^2,Type of soil: Rocky , Response spectra :As per IS 1893(Part1):2002, Damping of structure:5 %

B. Material Detail and Section Properties
Beam of lighting: 230 mmx400mm, Columns: 400mmx400mm, Material homes of the shape resemble M20 grade of concrete, FE415 metal and also 13800 N/mm2 of modulus of elasticity of block stonework within the homes.
Live load on floor level and roof level are taken from IS-875 (Part-) considered RC framed buildings as residential usage.

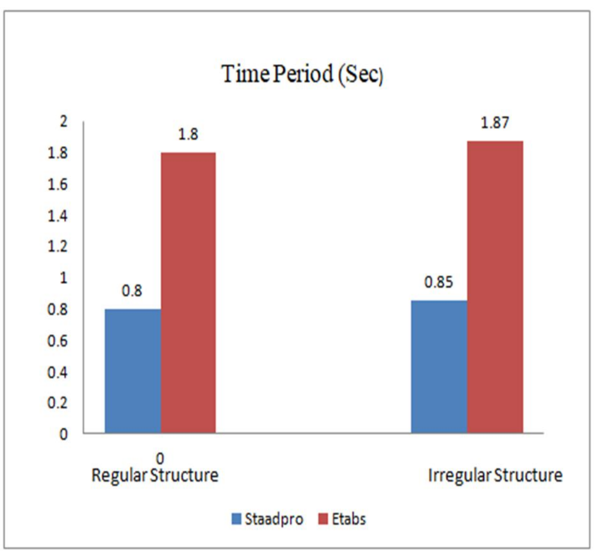
IV. RESULTS AND DISCUSSION

A. General
The results obtained in this work were discussed in this paper. The building models are subjected to dead load , live load, seismic forces and load combinations in order to understand the behavior of the G+8 building and their responses are observed. Time period and base shear for static loads were parameters studied. Similarly, bending moment, shear force and descriptions of reinforcement are studied.

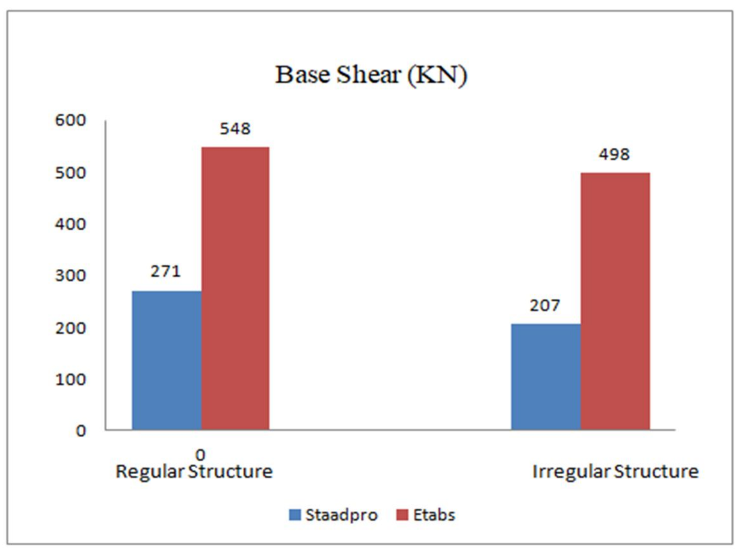
B. Comparison of Base shear and Time period
The static analysis is done for three forms of models. The Table1 indicates variations within the Base shear and Time period for the 2models.

Table1 Comparison of Base shear and Time period

Model	Softwares	Base Shear (KN)	Time Period (Sec)
Regular	Staad Pro	272.40	0.80
Irregular		270	0.85
Regular	Etabs	549	1.80
Irregular		499	1.87



Comparison of Time Period



Comparison of Base Shear

Comparison of Base shear and Time period

C. Bending Moment, Shear force, Axial force Comparision for Regular Structure

Table 2 Comparison of bending moment and shear force

Load Combinations	STAADPRO		ETABS	
	Bending Moments	Shear Force	Bending Moments	Shear Force
1.5(D.L+L.L)	22.40	44.05	11.7	32.4
1.2(D.L+L.L+EQX)	17.91	35.23	9.8	25
1.2(D.L+L.L+EQZ)	38.03	49.36	33.1	44.6
1.2(D.L+L.L-EQX)	17.93	35.25	11.5	28.8
1.2(D.L+L.L-EQZ)	40.52	49.6	32.2	45.25
1.5(D.L+EQX)	19.4	38.94	10.5	27.4
1.5(D.L+EQZ)	44.91	56.8	39.6	52.3
1.5(D.L-EQX)	19.31	38.9	12.7	32.3
1.5(D.L-EQZ)	47.29	56.69	38.6	53
0.9D.L+1.5EQX	11.61	23.3	8.6	16
0.9D.L+1.5EQZ	37.18	41.3	35.6	40.5
0.9D.L-1.5EQX	11.58	23.26	10.8	20.8
0.9D.L-1.5EQZ	39.68	41.19	34.6	41.8

Table 3 Axial Force of sample Column (Regular Structure) for Different Load Combinations

Load combinations	STAAD PRO	ETABS
	Axial force	Axial force
1.5(D.L+L.L)	989.50	964.80
1.5(D.L+L.L+EQX)	695.59	593.20
1.5(D.L+L.L+EQZ)	695.59	950.50
1.5(D.L+L.L-EQX)	887.74	950.50
1.5(D.L+L.L-EQZ)	887.74	593.30
1.5(D.L+EQX)	757.65	641.70
1.5(D.L+EQZ)	757.65	1088
1.5(D.L-EQX)	997.90	1088
1.5(D.L-EQZ)	997.90	641.70
0.9D.L+1.5EQX	405.60	296.60
0.9D.L+1.5EQZ	405.60	743.20
0.9D.L-1.5EQX	647.60	743.20
0.9D.L-1.5EQZ	647.60	296.50

D. Reinforcement Details For Beam And Column For Regular Structure

Table 4: Beam Concrete Design for Regular Structure In Staad Pro

Section(mm)	0	750	1500	2250	3000
Top Reinforcement	325.5	174.84	0	174.84	304.13
Bottom Reinforcement	174.84	174.84	174.84	174.84	174.84

Table 5: Beam Concrete Design for Regular Structure In Etabs(Required bars)

Section	Left	Middle	Right
Top Reinforcement(mm^2)	627	266	634
Bottom Reinforcement(mm^2)	333	266	356

Table 6: Column Reinforcement Details for Regular Structure

	STAAD PRO	ETABS
Required steel Area(mm^2)	701	1280
Provided steel Area (mm^2)	904.8	1280

E. Bending Moment And Shear Force Comparision For Irregular Structure

Table 7: Comparison of Bending moment and Shear force (Irregular Structure)

Load Combinations	STAADPRO		ETABS	
	Bending Moments	Shear Force	Bending Moments	Shear Force
1.5(D.L+L.L)	23.66	44.92	12.12	32.3
1.2(D.L+L.L+EQX)	18.93	35.94	9.9	25.01
1.2(D.L+L.L+EQZ)	26.59	41.32	26.36	39.4
1.2(D.L+L.L-EQX)	18.92	35.93	11.5	28.6
1.2(D.L+L.L-EQZ)	24.96	39.69	26.5	40.3
1.5(D.L+EQX)	20.6	39.81	10.6	27.5
1.5(D.L+EQZ)	30.17	46.53	31.3	45.6
1.5(D.L-EQX)	20.59	39.8	12.7	32.02
1.5(D.L-EQZ)	28.29	44.6	31.4	46.6
0.9D.L+1.5EQX	12.36	23.84	6.5	16.6
0.9D.L+1.5EQZ	21.94	30.61	27.5	34.4
0.9D.L-1.5EQX	12.35	23.88	8.6	20.5
0.9D.L-1.5EQZ	21.22	29.45	27.2	35.2

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Table 8: Axial Force of sample Column (Irregular Structure) for Different Load Combinations

Load Combinations	STAADPRO	ETABS
	Axial Force	Axial Force
1.5(D.L+L.L)	314.22	323.7
1.2(D.L+L.L+EQX)	215.5	184.7
1.2(D.L+L.L+EQZ)	227.2	330.19
1.2(D.L+L.L-EQX)	287.2	333.15
1.2(D.L+L.L-EQZ)	275.5	187.7
1.5(D.L+EQX)	238.3	198.3
1.5(D.L+EQZ)	252.9	383.84
1.5(D.L-EQX)	327.9	202.15
1.5(D.L-EQZ)	313.2	380.5
0.9D.L+1.5EQX	125	81.9
0.9D.L+1.5EQZ	139.7	264.11
0.9D.L-1.5EQX	214.6	267.8
0.9D.L-1.5EQZ	200	85.6

F. Reinforcement Details For Beam And Column For Irregular Structure

Table 9 : Beam Concrete Design for Irregular Structure In Staad Pro

Section(mm)	0	750	1500	2250	3000
Top Reinforcement	197	173.83	0	173.83	210.3
Bottom Reinforcement	0	173.83	173.83	173.83	0

Table 10: Beam Concrete Design for Irregular Structure In Etabs (Required bars)

Section	Left	Middle	Right
Top Reinforcement(mm^2)	495	188	517
Bottom Reinforcement(mm^2)	218	224	238

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Table 11: Column Reinforcement Details for Regular Structure

	STAAD PRO	ETABS
Required steel Area(mm^2)	225.45	1280
Provided steel Area (mm^2)	904.8	1280

V. CONCLUSION

The analytic study is carried out in order to compare the behaviour of regular structure with irregular structure by using STAAD.PRO & ETABS. The structures are designed using IS: 456:2000 and IS 1893:2002 codes. From the study the following conclusions are obtained.

Compared to the ETABS software, STAAD.Pro software is more flexible to work. This is because ETABS has many input requirements that in the initial stage might be difficult to understand.

From the Beams, Columns design results, we can conclude that Staad pro gave less required area than Etabs.

The frame elements of regular structure showed maximum bending moments, shear forces and axial force among the two structures considered (Regular and Irregular structure).

In building design using both STAAD.Pro and Etabs analysis the quantity of provided steel is same.

Economic section are developed using Staad.pro and Etabs through the comparative analysis and design analysis of G+8 building.

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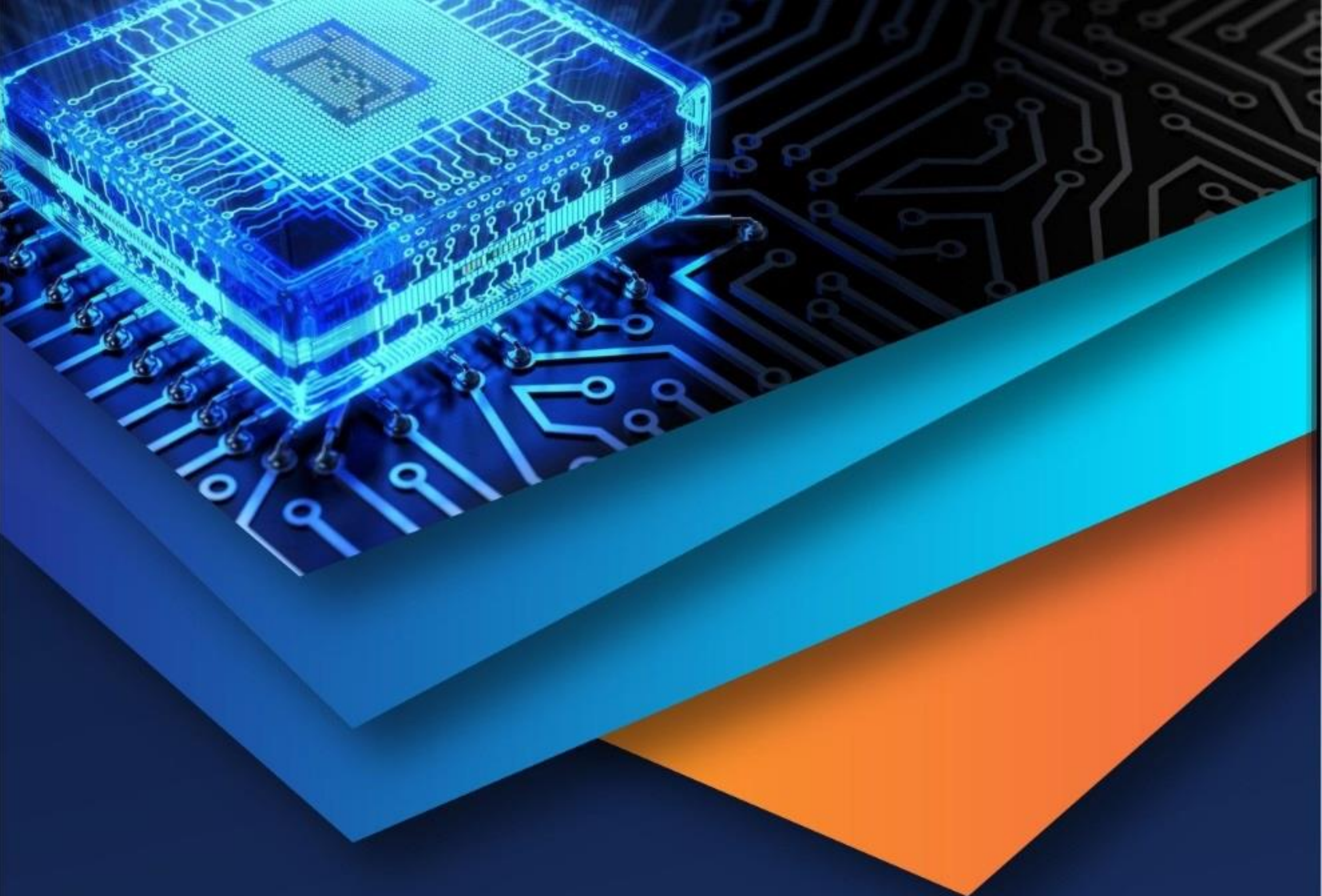

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