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Study of Vertically Irregular Building with Ground Floor Soft Storey

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Abstract*: It is generally believed that the regular buildings have a dominant fundamental mode participation in their seismic response and as the irregularity increases the contribution of higher mode increases. Accordingly, previous studies have proposed methodologies to quantify the vertical irregularity of the buildings in terms of their fundamental mode properties. In the present work various models with unique type of vertical irregularities will be analyzed with the help of Staad Pro. And an comparatively stable model amongst all models are plotted and from this various conclusions are drafted which are listed below
Keywords: Structural Parameters, Irregularities, Axial force, Displacement, Base shear.

I. INTRODUCTION

Main structural damages occur when Dynamic Loads including both Earthquake and Wind loads are applied on a building. In these modern days, most of the structures are constructed with architectural significance and it is extremely impossible to plan with regular shapes.

These irregularities are responsible for structural collapse of buildings under the action of dynamic loads At the time of an earthquake, structure starts to fail at the points of weakness. This weakness arises due to discontinuity in mass, stiffness and geometry of the structure.

The building structures having this type of discontinuity are termed as Irregular structures. Irregular structures contribute a large portion of urban infrastructure. Vertical irregularities are one of the main reasons of failures of building structures during earthquakes. As an example structures with soft storey were the most not able structures which collapsed. So, the effect of vertically irregularities on the seismic evaluation of structures becomes actually important. Height-wise changes in stiffness and mass render the dynamic characteristics of these buildings different from the regular building.

II. AIM

The aim of present work is to study the effect of vertically irregular building with soft storey at ground floor.

III. OBJECTIVE

The objectives of present work are as follows :-

A. To compare the seismic performance of multi-storey buildings having vertical irregularity at different positions.
B. To compare the base shear and node displacement, time period, frequencies of different buildings.
C. To identify the best building configuration from this analysis.
D. To analyze the building as per code IS 1893-2002 part I criteria for earthquake resistant structure.
E. To study effect on Maximum Bending Moment in Beams and Columns.

IV. METHODOLOGY

The project work will be work out in following phases
The whole is Divided into 3 Main Phases

A. PHASE-I

1) To Decide Aim, Objective and Need of Work.
2) To Review Various Literatures, Codes and Journals.
3) To decide the flow of work i,e Methodology.

B. PHASE-II

1) Detail Study of all possible Structural Effects.
2) Effect of Earthquake and Its parameter.
3) Types of loading and Methods of Analysis.
4) Soft storey Consideration.
5) Fixing All general Structural Data and Case Considerations of Models.

C. PHASE –III

1) Analyzing all the selected model patterns.
2) Drafting of Comparative result Statements.
3) Discussing all obtained Results.
4) Conclusions on results obtained after analysis and Discussion.

V. STRUCTURAL PARAMETERS

Table 1 Detail Structural Parameters

Parameter	Value
Live load	3 kN/m2
Density of concrete	25 kN/m3
Thickness of slab	130 mm
Depth of beam	300 mm
Width of beam	230 mm
Dimension of column	300 x 450 mm
Thickness of outside wall	230 mm
Thickness of Parapet wall (1m)	100 mm
Height of floor	3.05 m
Earthquake zone	II
Damping ratio	0%
Type of soil	II
Type of structure	Special moment resisting frame
Response reduction factor	5
Importance factor	1
Roof treatment	1 kN/m2
Floor finishing	1 kN/m2
Number of Storey’s	10

VI. MATERIAL PROPERTIES

Table 2 material properties

Material	Concrete	Steel
Grade	M 25	Fe 415
Mass Density	2549.3	7849
Unit Weight	25	76.97
Modulus of Elasticity	25,000,000	20,000,000
Poisson’s Ratio	0.15	0.3

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VII. MODEL NOMENCLATURE

Each model according to its specific floor condition are labeled as follows :-

Table 3 Model Description

Model Description	Label
Floor wise Irregularity	V1
U- Shape Vertical Irregularity	V2
Irregularity at central portion	V3
Irregularity within on side central portion	V4
Irregularity at one of the corner portion	V5
Inverted U-Shape Irregularity	V6
Irregularity within central core portion	V7

VIII. 3D VIEW OF MODELS

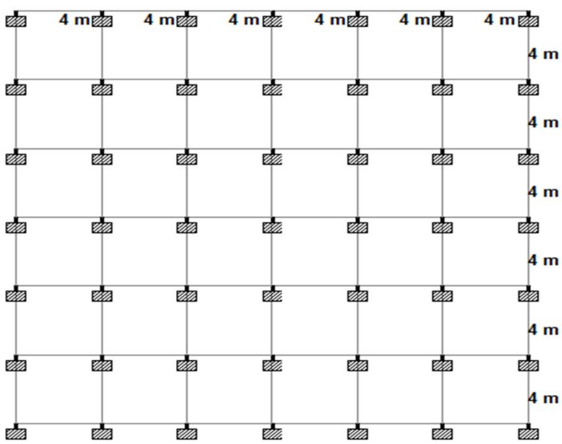

Fig.01Plan

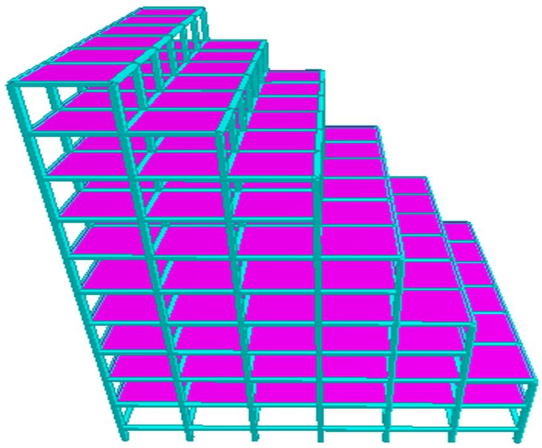
Fig.02 Model V1

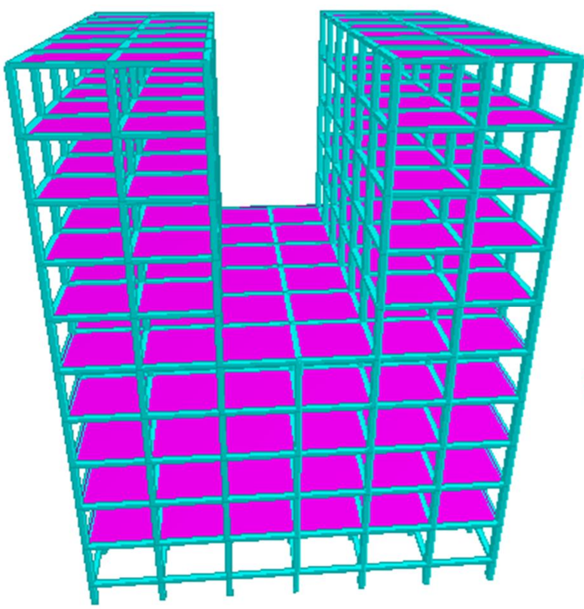
Fig.03 Model V2

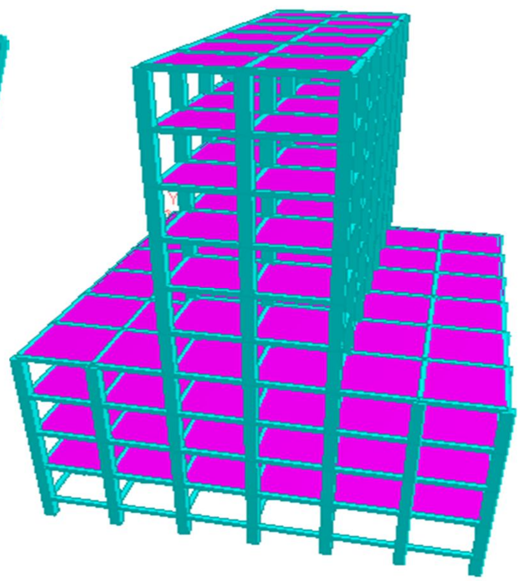
Fig.04 Model V3

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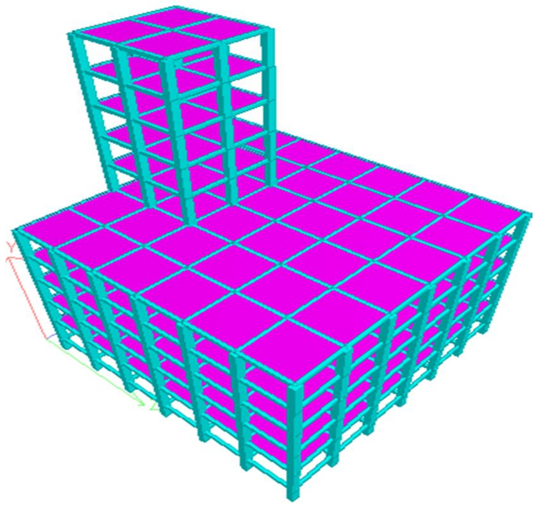

Fig.05 Model V4

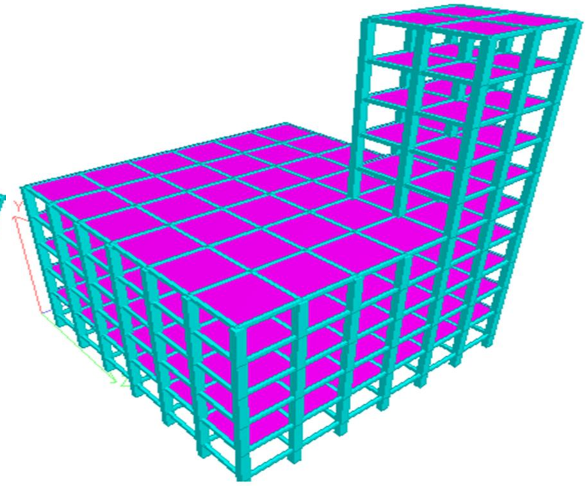

Fig.06 Model V5

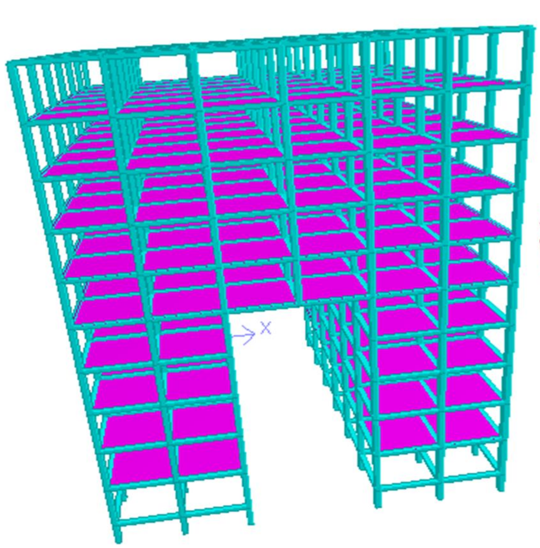

Fig.07 Model V6

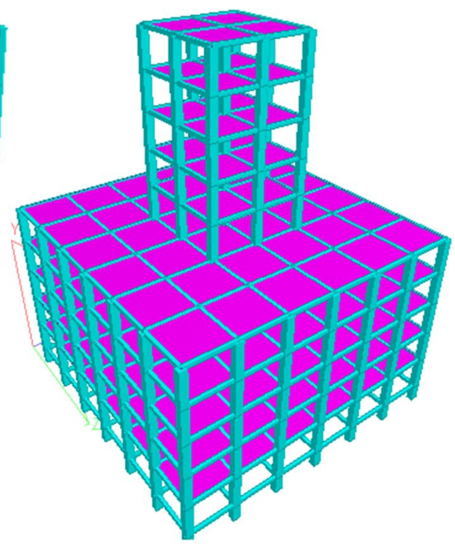

Fig.08 Model V7

IX. RESULTS FOR ALL MODELS

Table 04 comparative results of all models

Model	Base shear	Displacement	Reaction	Moment	Modal Time Period
V1	570.58	63.91	6179.08	129.32	2.037
V2	733.05	61.67	6354.56	142.37	2.379
V3	529.77	61.91	3469.33	121.90	2.00
V4	488.44	61.84	4325.1	128.56	1.685
V5	488.44	73.88	5622.77	129.93	1.691
V6	752.91	78.94	6600.57	282.29	2.821
V7	488.44	60.00	4324.49	114.96	1.633

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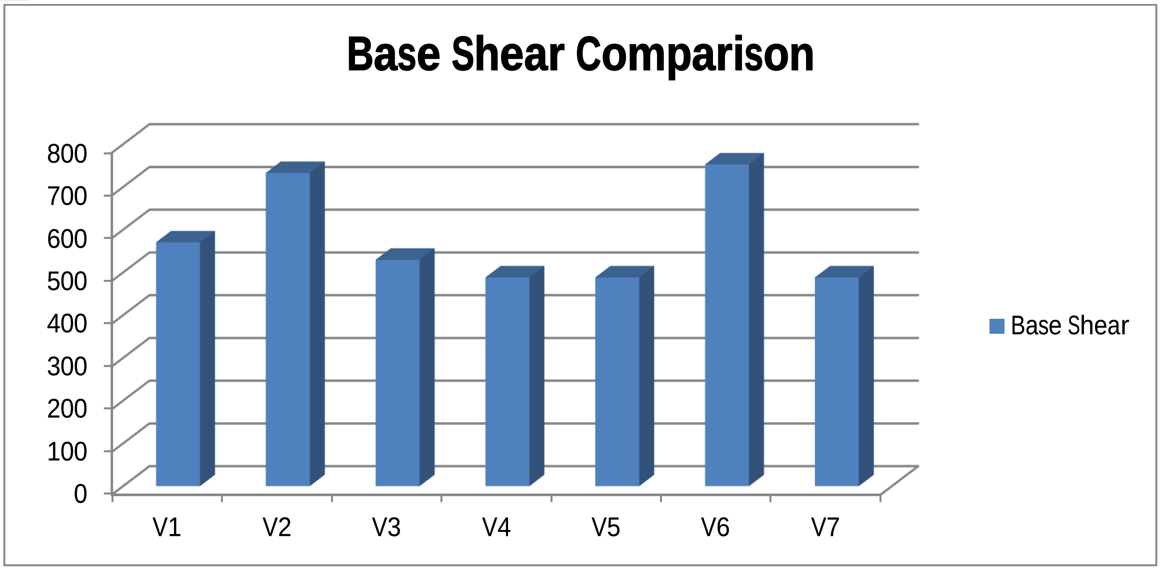

Fig.09 Comparison of Base Shear for all model

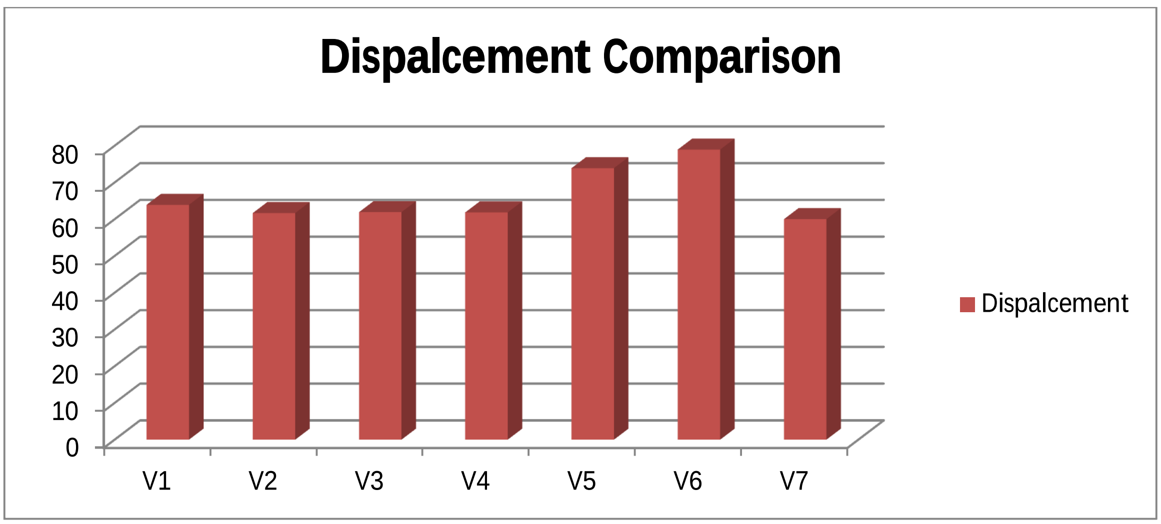

Fig.10 Comparison of Displacement for all model

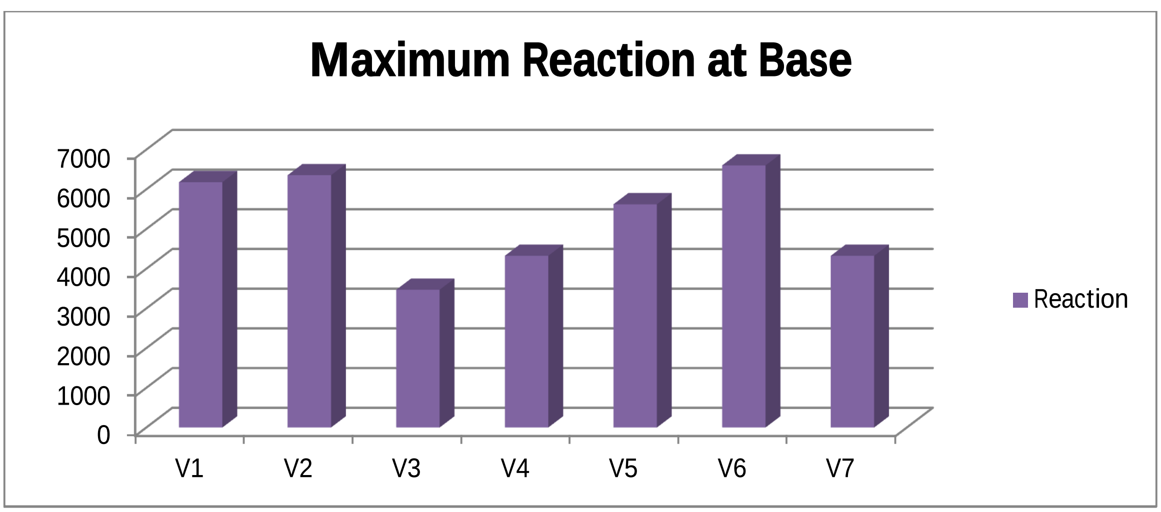

Fig.11 Comparison of Reaction for all model

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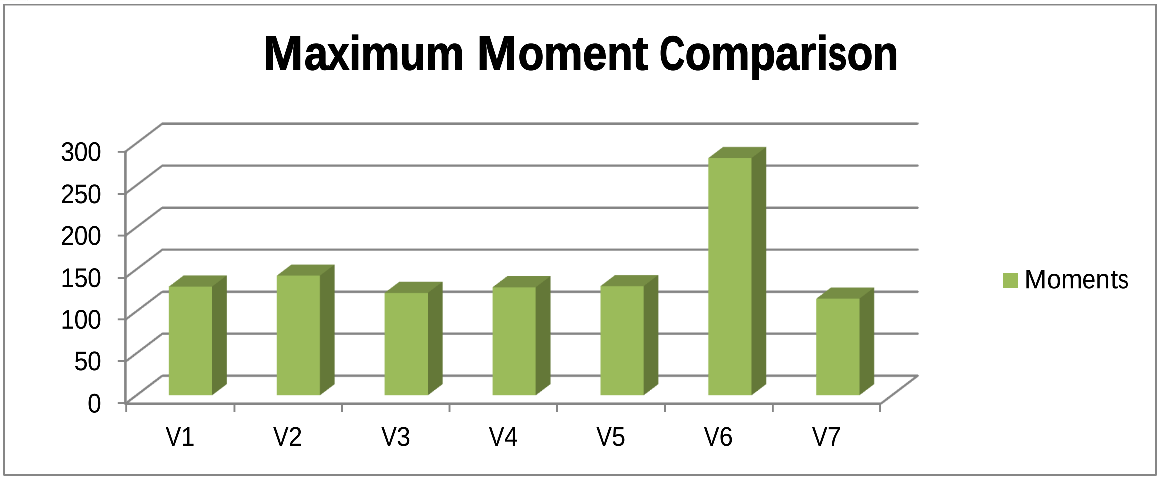

Fig.12 Comparison of Maximum Moment for all model

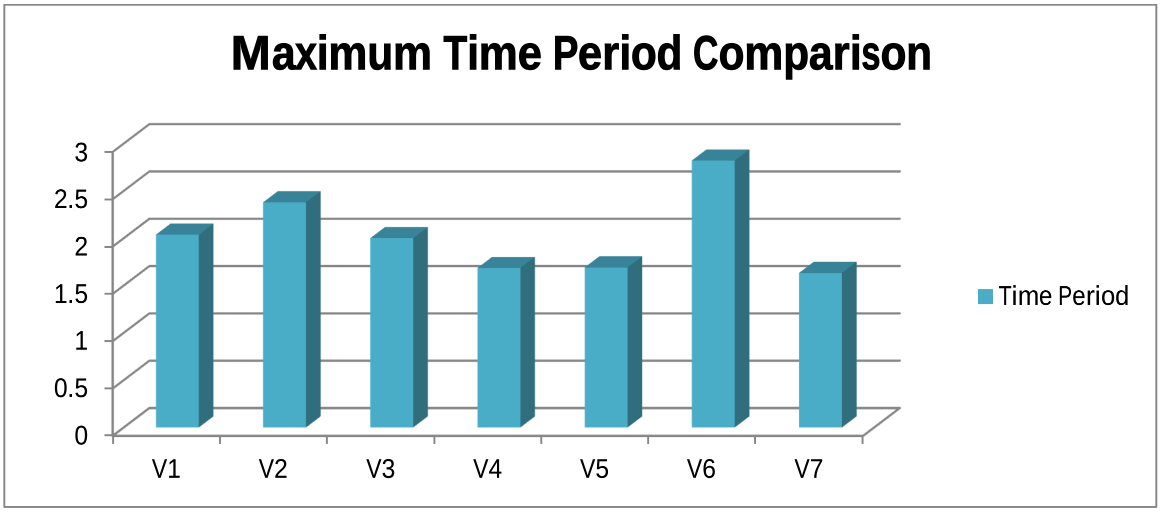

Fig.13 Comparison of Time period for all model

X. CONCLUISONS

A. Base shear for models having irregularity at centre, corner and middle side portion are lower than other irregularities.
B. Model with vertical irregularity located at centre of building gives lowest values of Axial forces, Displacement, and Moments.
C. U shape and Inverted U shape buildings should not be used as they gives maximum axial forces and time period
D. Models with central, Corner and side Irregularity requires maximum time period than other models.
E. For stability irregularity should be beyond half height of structure.

XI. ACKNOWLEDGEMENT

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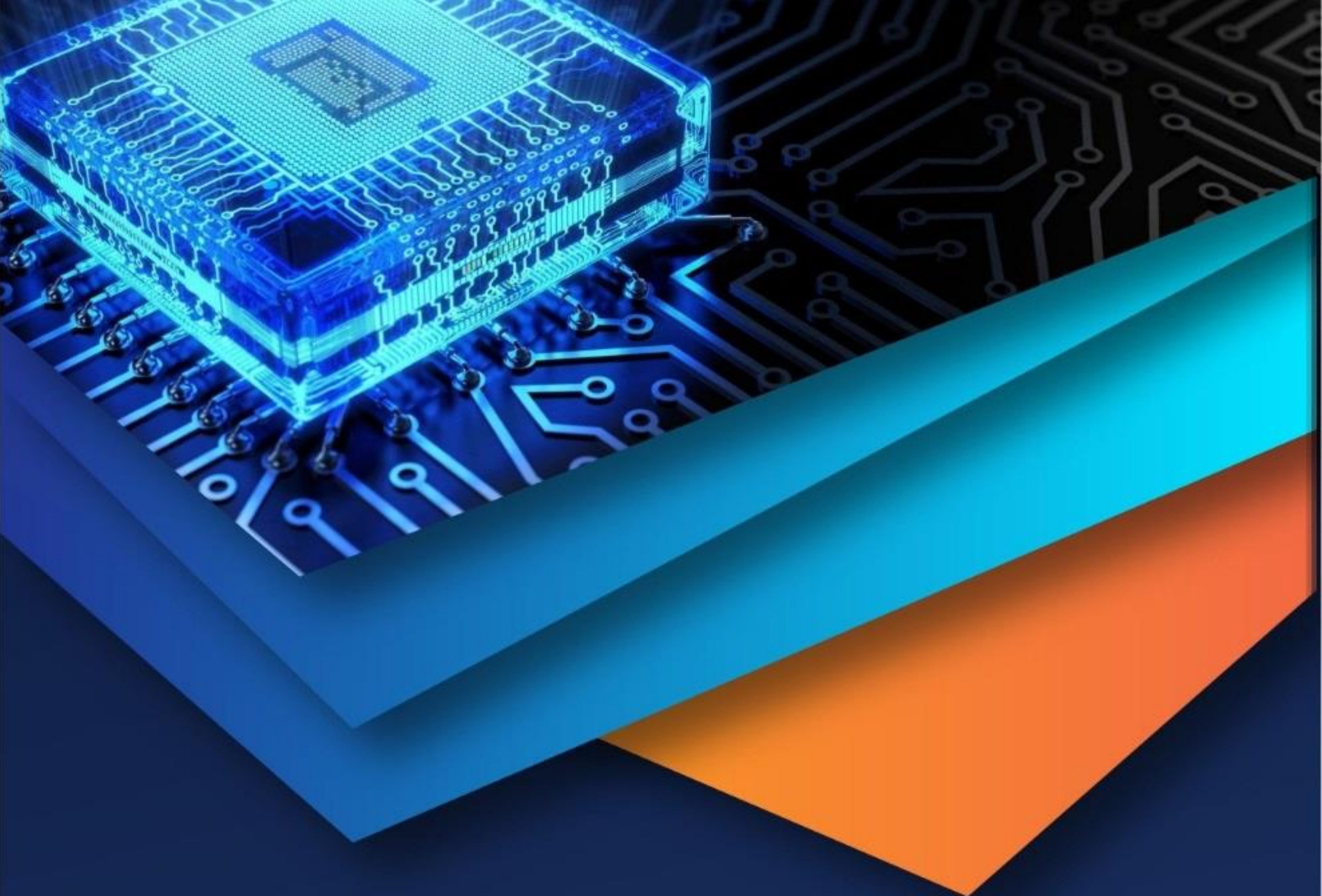

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