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Comparative Analysis and Design of "Circular and Rectangular Clarifier" by Etabs

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Abstract: The main purpose of structural engineer is projecting of constructions for safe technology in a computing field; A structural engineer can safely solve a much larger and more complex structure that lends itself to a different type of boot state. Earlier loads acting on the structure are considered static, but strictly speaking, except for self-weight (dead load) without the load structure is static one now the day a large number of applications are available in the field of civil engineering. All of these software programs are developed as a basis of advanced. Analysis of finite elements, which include the effect of dynamic load, such as wind effect, earthquake rate effect of Earth, etc. In this work, has been attempted to examine the effectiveness of some applications of civil engineering. In the present work the analysis and design of circular and rectangular clarifier is carried out in the software. It was found that the circular clarifier gives the minimum forces and moments than rectangular clarifier.
Keywords: Circular clarifier, rectangular clarifier, reinforcement, analysis & moments

I. INTRODUCTION

Clarifier (also links as clarifiers or settlers) are an integral part of each wastewater treatment. These treatment facilities are used to remove solids from wastewater by settling gravity at rest. All Clarifier have two functional zones – this is clarification of the zone where the process of gravity settling takes place, and the thickening of the zone where the subsidence of solids accumulates, forming a dense layer of silt (slurry blanket). Wastewater clarifiers with low particulate matter is assembled from the top of the refining area over the overflow of dams in the Channel collection, which transmit drains to the outlet tank. Sludge collected at the bottom of Clarifier is removed for further treatment at the objects of treatment facilities. Depth refinement zone is commonly referred to as pure Water Zone (CWZ) depth, while the depth on the accumulation area of sludge is named sludge blanket depth.

A. Types of Clarifiers

Depending on their function, the Clarifier are classified as primary and secondary. The primary fresheners positioned down the downward water treatment plant and their primary purpose is to remove the settlers of weighted solids on the plant affected. As a rule, primary Clarifier are also equipped with devices for the removal of a floating compound (that is, scum, oil and fat) in wastewater that accumulate on the surface of the tanks during settling.

Secondary tanks are located downstream of the biological (secondary) treatment facilities of the wastewater treatment plant (for example, activated sludge aeration of basins or drip filters) and used for separation of biomass, generated during secondary process of treatment from treated plant effluent.

Depending on their geometric shape, both primary and secondary Clarifier are divided into two main categories: rectangular and round. Clarifier form most suitable for this program depend on a number of factors and should be chosen based on the cost and benefit analysis. Table 1 concludes key advantages and disadvantages of rectangular and round clarifiers.

II. REVIEW OF LITERATURE

The secondary Clarifier are equipment used in treatment plants for the gravitational separation of solid particles from the water. Since this process is chemically activated by the addition of floccuants to improve subsidence, the mathematical model can be designed taking into account the model of the mixture and taking into account the relative velocity between the continuous stage and the liquid one. The author studied the issue of mathematical modelling of subsidence process in secondary Clarifier (Michaela Flori et al. 2016).

To assess the proposed modifications of the tank was applied 3-dimensional completely mass conservative Clarifier model, based on modern computational fluid theory, which allows to determine the maximum capacity of existing and modified Clarifier. The computational fluid (CFD) model is formulated to describe the tank-performance, and design parameters were derived from experimental results. The study found that the velocity and (weighted solids) SS is a better parameter than the TS (total solids), (biochemical oxygen needs) of the BODS, (the chemical need for oxygen) to gauge the performance of sedimentation and that

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removes the efficacy of weighted solids, the biochemical oxygen requirements, and the chemical oxygen demand were higher in the deflector (Ali G. Ghawi ET 2011)

The dye tests showed that only the front three of the seven slots received an inflow of 0.57 m^3/m^2 HR, which is the highest Three different bulls, with 12 different SS (suspended solid) concentration at each speed overflow, were fed as Clarifier. However, Clarifier with inclined plates were unable to show the improved removal rate for the SS. In order to have the effect of a boycott in the nest, it is assumed that each slot, created by slanted plates, gets leveled by an influx. In addition, it is necessary to avoid the collision of inflow with sludge settling at the bottom of the clarifier. These provisions, which can maximize the effect of the boycott, must be added to the standards for the water Works approved by the Korean Government (Byonghi Lee 2015).

III. MODELING

The modeling of rectangular clarifier is as follows:

Table 1: Description of the rectangular clarifier

Plan dimensions	15x5 m
Total height	4 m
Thickness of clarifier walls	350 mm
Floor finishes on top slab	1.5 kN/m^2
Live load on top slab	3 kN/m^2
Grade of Concrete	M30
Grade of Steel	Fe500
Density of Concrete	25 kN/m^3
Density of Water	10 kN/m^3

Fig.1 Plan of rectangular clarifier

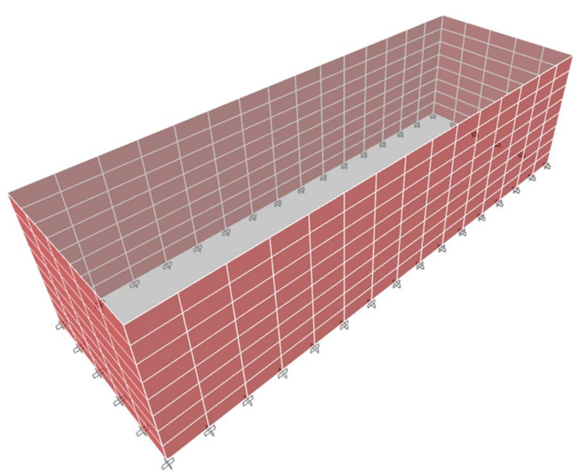

Fig.2: 3D Model of rectangular clarifier in ETABS

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The modeling of circular clarifier is as follows:

Table 2: Description of the Circular clarifier

Diameter	14.8 m
Total height	3.5 m
Thickness of clarifier walls	300 mm
Grade of Concrete	M30
Grade of Steel	Fe500
Density of Concrete	25 kN/m^3
Density of Water	10 kN/m^3

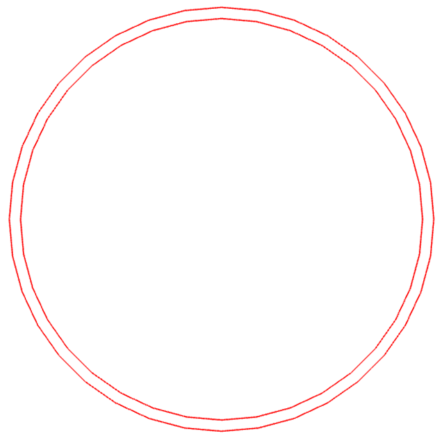

Fig.3: Plan of Circular clarifier

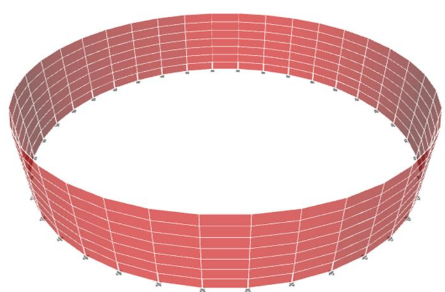

Fig.4: 3D Model of Circular clarifier in ETABS

IV. ANALYSIS

Rectangular clarifier is assumed to be resting on ground. ETABS model is prepared of rectangular clarifier for water full condition as a propped cantilever, since tank empty conditions will not governing condition. Total height of water to be retained is 4.0 m therefore water load is as shown below.

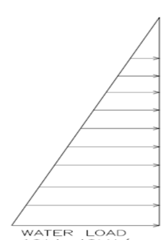

Fig.5: Water load on wall

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V. RESULTS

A. Vertical Moment Diagram for DL+LL+Water

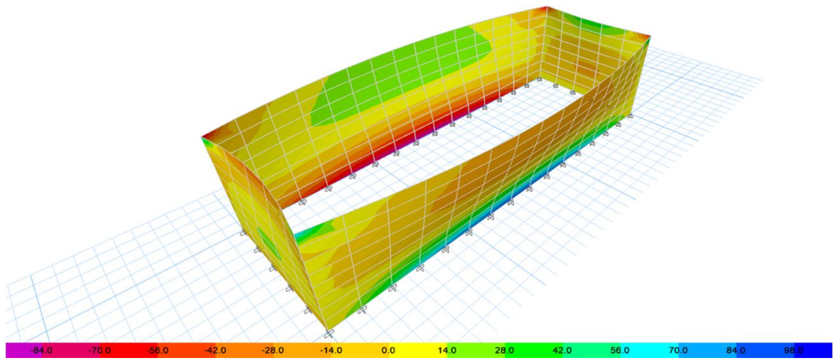

Fig.6 : Horizontal Moment Diagram for DL+LL+Water

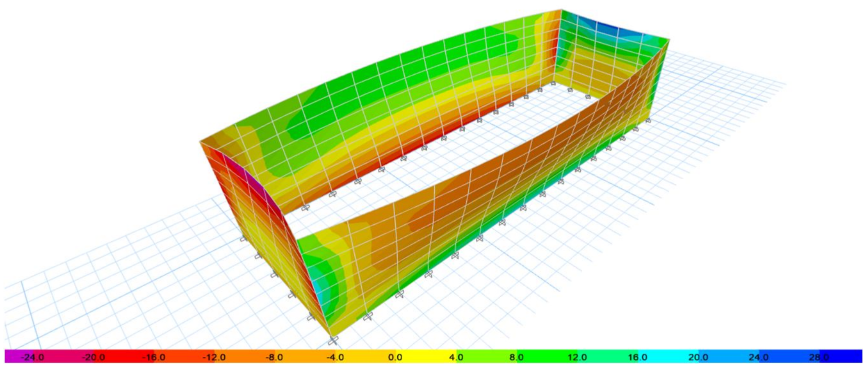

Fig.7: Vertical Moment in long Wall for DL+LL+Water

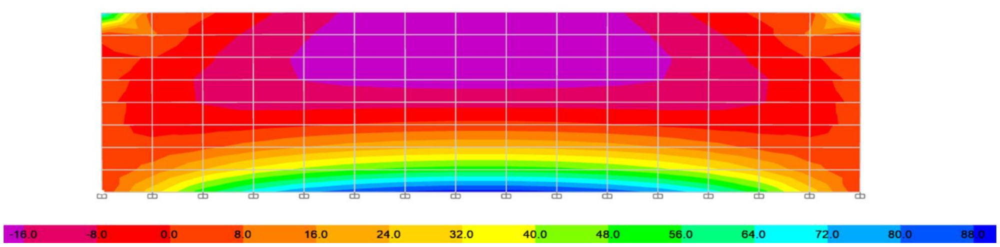

Fig.8: Moment distribution on wall

From analysis Vertical Bending moment at outer face is = 16.00 kNm
From analysis Vertical Bending moment at inner face (water face) is: 88.00 kNm

B. Horizontal Moment in long Wall for DL+LL+Water

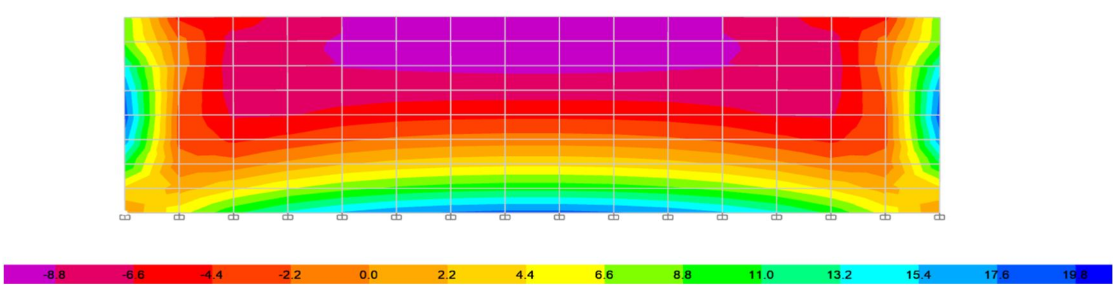

Fig.9: Moment distribution on wall

From analysis max horizontal Bending moment is = 19.8 kNm

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C. Vertical Moment in Short Wall for DL+LL+Water

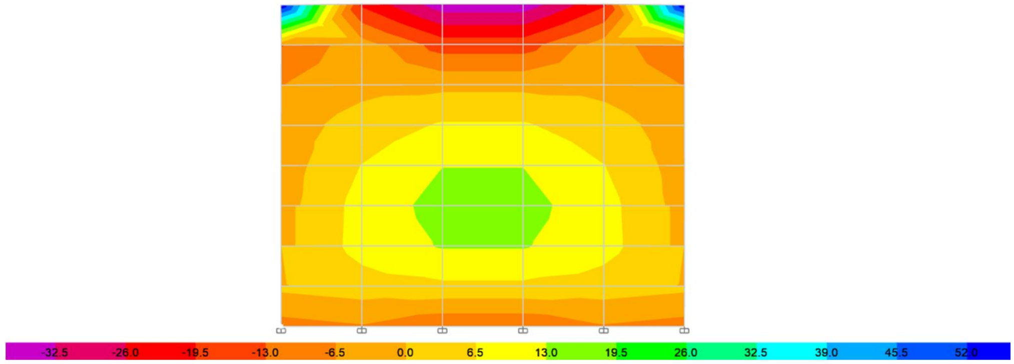

Fig.10 : Moment distribution on Short wall

From analysis Vertical Bending moment at outer face is = 32.5 kNm
From analysis Vertical Bending moment at inner face (water face) is: 52.00 kNm

D. Horizontal Moment in Short Wall for DL+LL+Water

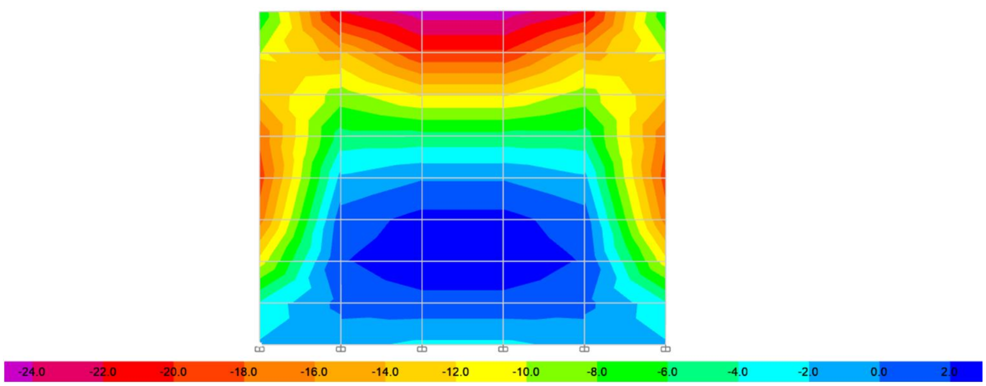

Fig.11: Moment distribution on shortwall

From analysis max horizontal Bending moment is = 24 kNm

Table 3: Analysis Result Summary (rectangular clarifier)

Long Wall	
Max Horizontal moment	19.8 kNm
Vertical moment at inner (water) face	88.00 kNm
Vertical moment at outer face	16.00 kNm
Short Wall	
Max Horizontal moment	24 kNm
Vertical moment at inner (water) face	52 kNm
Vertical moment at outer face	32.5 kNm

Table 4: DESIGN of rectangular Clarifier

Max Horizontal moment among short and long wall	24 kNm
Max Vertical moment at inner (water) face among short and long wall	88.00 kNm
Max Vertical moment at outer face among short and long wall	32.5 kNm

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From the moment and forces the design is carried out and the reinforcement details are obtained as follows.

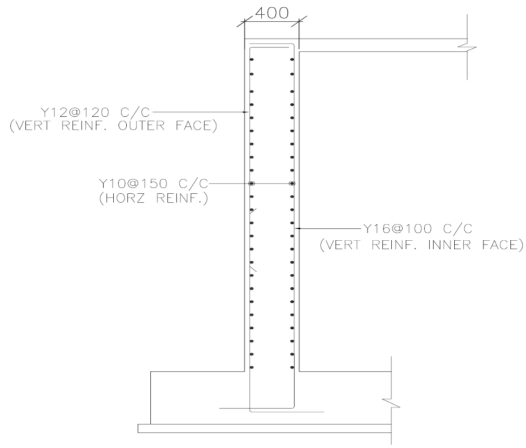

Fig.12: Reinforcement Details of Clarifier

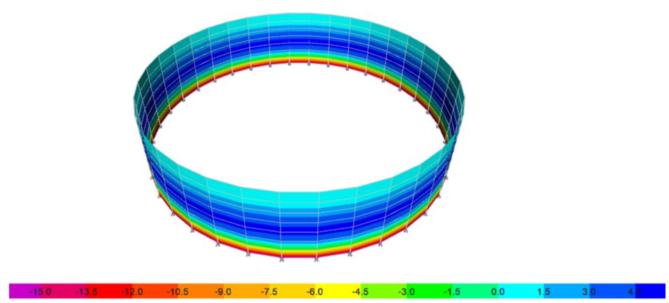

Fig.13: Vertical Moment Diagram for DL+Water (Circular Clarifier)

From analysis Vertical Bending moment at inner face (water face) is: 15.00 kNm

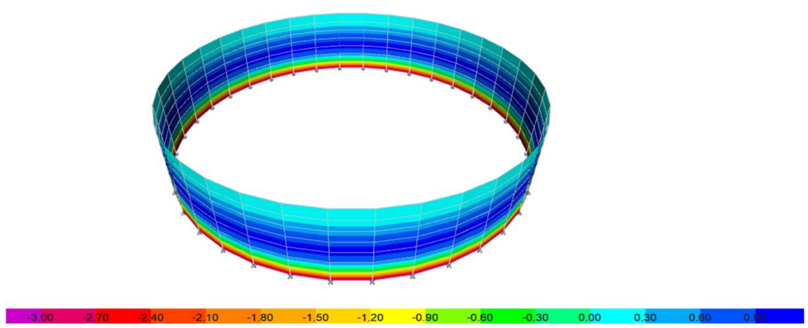

Fig.14: Horizontal Moment Diagram for DL+Water

From analysis max horizontal Bending moment is = 3 kNm

Table 5: Analysis Result Summary (Circular clarifier)

Max Horizontal moment	3 kNm
Vertical moment at inner (water) face	15 kNm

Table 6: Moment of Circular clarifier

Max Horizontal moment	3 kNm
Vertical moment at inner (water) face	15 kNm

From the above forces and moments the reinforcements are calculated and shown in the below diagram.

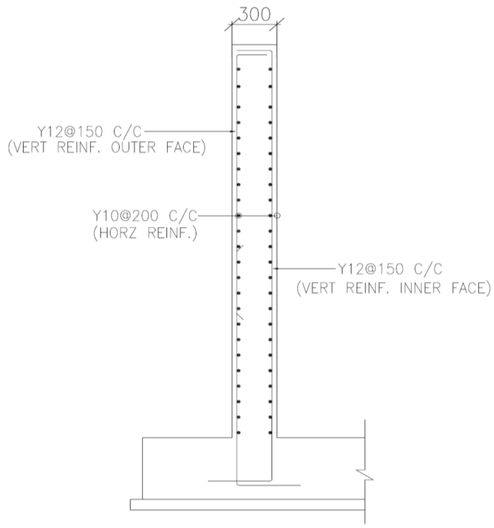

Fig.15: Reinforcement details of circular clarifier

VI. CONCLUSION

From the above study following conclusions can be drawn:

A. Maximum Vertical Bending moment at inner face-long wall (water face) is: 88.00 kNm
B. maximum horizontal Bending moment-long wall is = 19.8 kNm
C. Maximum Vertical Bending moment at inner face-short wall (water face) is: 52.00 kNm
D. maximum horizontal Bending moment-short wall is = 24 kNm
E. The reinforcement is provided on both side of wall
F. From the above work the circular clarifier gives lesser moments than the rectangular clarifier.

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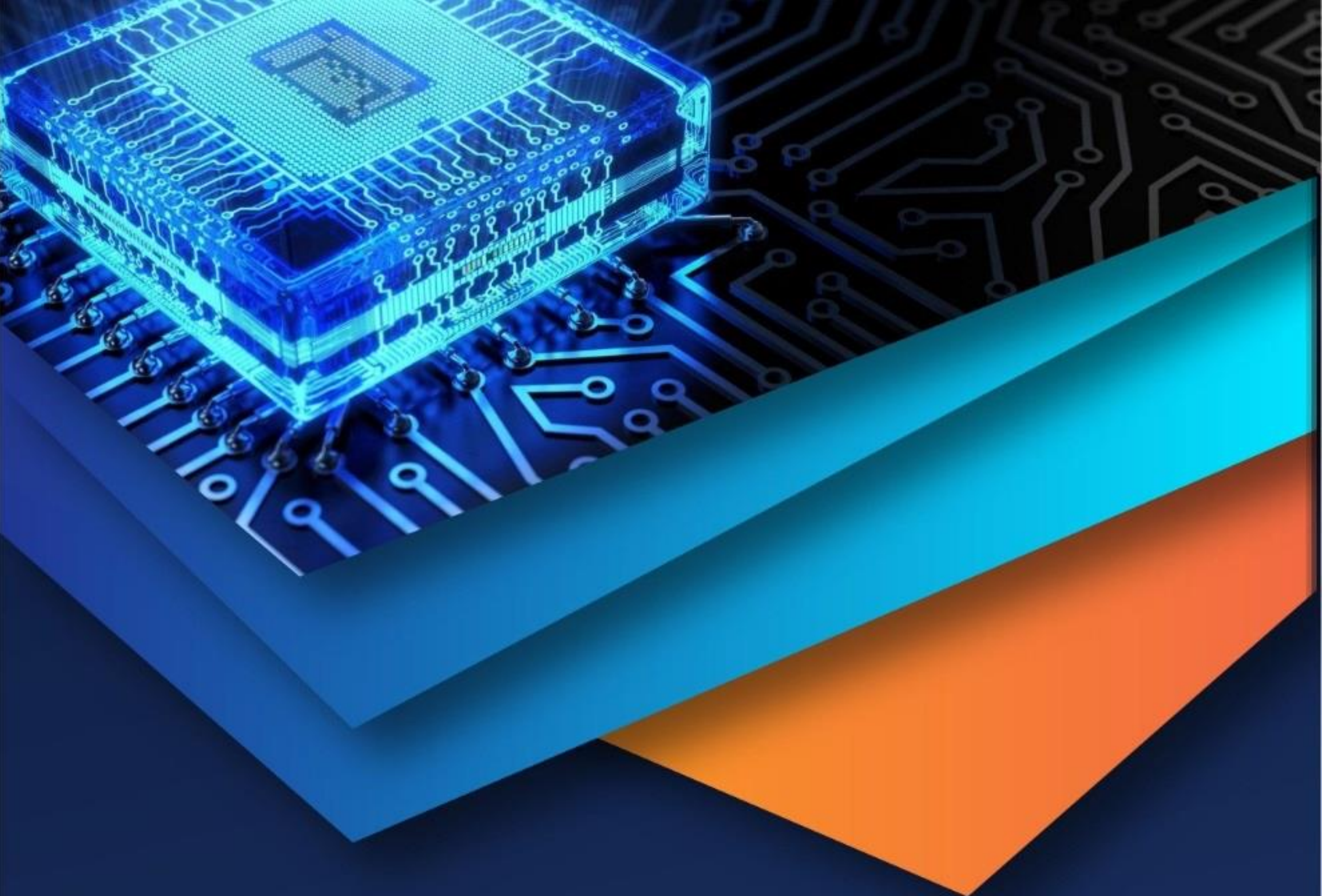

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