iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** III **Month of publication:** March 2025

DOI: https://doi.org/10.22214/ijraset.2025.67575

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue III Mar 2025- Available at www.ijraset.com

A Study on Performance and Evaluation of Various Properties of Self Compacting Concrete

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Abstract: ***Self compacting concrete is a high Performance concrete plays a major role in composite materials industry .This study investigates In detail about the effect of fly ash on the fresh properties of Self-Consolidating Concrete (SCC). SCC is widely recognizedconcrete usedfor its high flowability and ability to self-compact or flow without external vibration, making it highly suitable for structures with dense and complex reinforcement. The study was conducted using six different SCC mixtures with varying fly ash dosages (from 5g, to 30g). author try to give bestresults by conducted Standardized workability tests, including the J-Ring, V-Funnel, Inverted Slump Flow, L-Box, and Sieve Stability tests Etc.Test were performed by authors to evaluate the fresh properties of Self Compacting Concrete. Writers finds that The results indicate that moderate fly ash additions mainly (10g–15g) significantly improved flowability, stability, and segregation resistance and other properties , whereas higher dosages above (>20g) increased viscosity, leading to reduced flow but enhanced cohesiveness. Alsowe finds that SCC without fly ash displayed lower workability and higher segregation. We usesComparative graphs and tabulated data for the learners for easy understanding demonstrating that fly ash enhances SCC performance by making it a practical supplementary material for enhancing mix designs in construction Practices.***

Keywords: SCC , opc, Fly Ash ,construction, Self compacting concrete , Test Performed, v funnel etc.

I. INTRODUCTION

Self-Compacting Concrete (SCC) was developed to Overcome the challenges in ordinary concrete especially in composite structures with congested and heavy reinforcement. It boosts construction efficiency, improves durability, and confirms superior finishes. SCC is widely used in prepared and cast-at-site applications also significantly reducing workmen costs and construction time (Okamura & Ouchi, 2003).

A. Materials Used in SCC

We find that SCC contains the following topmost components:

1) Cement: Ordinary Portland Cement (OPC).
2) Fine Aggregates:After studying literature we find fine aggregates Typically sand with a particle size less than 4.75 mm.
3) Coarse Aggregates:coarse aggregate mainly Smaller-sized aggregates (10-20 mm) to maintain workability of concrete.
4) Water:water is essential ComponentToMaintainthe required water-cement ratio for hydration.
5) Admixtures:admixtures mainly Superplasticizers (for flowability) and viscosity-modifying agents (for stability) (De Schutter &Audenaert, 2007).
6) Supplementary Cementitious Materials (SCMs): We find Fly ash, silica fume, or ground granulated blast furnace slag (GGBS) improve performance of SCC.

B. Important Properties of SCC

1) It offers High flowability and filling ability.
2) It provideStability with minimal segregation.
3) It has Excellent passing ability through congested reinforcement.
4) Scc has Improved surface finish and durability.
5) With Reduced labor costs due to self-consolidation (Felekoğlu et al., 2007).

II. METHODOLOGY

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writers studied various reserch articles to find the best methodology for scc.Standard Test prescribed as per IS Codes are followed and conducted at various different site locations near Ambala and Barara .

The Test was conducted using six different SCC mixtures with varying fly ash dosages (from 5g, to 30g). we perform several test like v funnel slump flow test etc. Test regarding compressive strength and water absorption is also performed accordingly.

Various other test regarding concrete Properties are performed and evaluatedat a private site near ambala.Suitable Data if not Available is assumed. We found out that higher the flyash higher the compressive strength. The production of SCC mainly involves careful proportioning and mixing to achieve the desired properties as follow :

- Step 1 Mix Design: The proportion of materials is determined using established guidelines as per is codes and standards (EFNARC, 2002).
- Step 2 Batching and Mixing:Batching ensures Proper sequencing of materials ensures uniform consistency.
- Step 3 Testing for Workability and Stability:Authors suggests that Fresh SCC should always be tested before placement.
- Step 4 Placing and Curing: SCC should be poured directly into formwork without vibration and curedappropriately to gain maximum strength (Domone, 2007).

A. Various TestConducted forSelf Compacting Concrete

Various tests that evaluates the workability and performance of SCC are as follows:

1) Slump Flow Test:It majorly Measures horizontal spread and flowability (EFNARC, 2002).
2) V-Funnel Test:Authors concluded that v funnel testEvaluates the viscosity and filling ability of self compacting concrete.
3) L-Box Test:we find L Box Test Determines the passing ability of concrete through reinforcement.
4) U-Box Test:whereas U box test Measures flow and segregation resistance.
5) Segregation Resistance Test: Ensures uniformity in mix composition.
6) Compressive Strength Test: Evaluates mechanical performance after curing (Sonebi, 2004).

B. Major Advantages of SCC

1) SCC Eliminates Major vibration, reducing noise pollution.
2) It Enhances speed of construction and its efficiency.
3) It Improves structural integrity ,durability and homogeneity.
4) It Ensures better surface finish with less defects.
5) It Reduces labour and equipment costs (Khayat, 1999).

C. Applications of Self Compacting Concrete

1) High-Rise Buildings:Self Compacting Concrete Facilitates efficient concrete placement at height.
2) Precast Concrete Industry:we find It Enhances mould filling and surface quality during test.
3) Bridge Structures:It Improves durability in heavily reinforced sections For example Bridges , Decks etc.
4) Tunnels and Underground Structures:In case of tunnel engineering and underground structures it Guarantees uniform filling without vibration.
5) Repair and Retrofitting Works:we find it also Facilitates easy placement in confined spaces (Ouchi et al., 1999).

III. RESULTS AND DISCUSSION

We have conducted the test for scc and prepared different results in the form of charts and graphs, are as follow :

- J-Ring Test:
  d1 =550mmd2= 530mm and
  J-RingFlow=540 mm
- V-Funnel Test: we find Time taken by V funnel is = 8.62 sec (indicates flowability)
- Inverted Slump Flow:it is Measured at 625 mm in 2–2.5 sec
- L-Box Test: Calculate passing ability:= 0.826
- SieveStability:15–18 segregation

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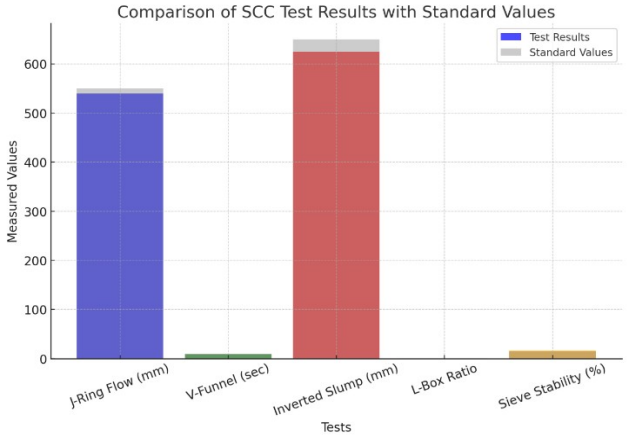


Figure No 1Comparision of SCC test at Standard Values



2(a) 2(b)

Figure No 2 J Ring Test

Figure No 3 L Box Test

Figure No 4 Slump Test





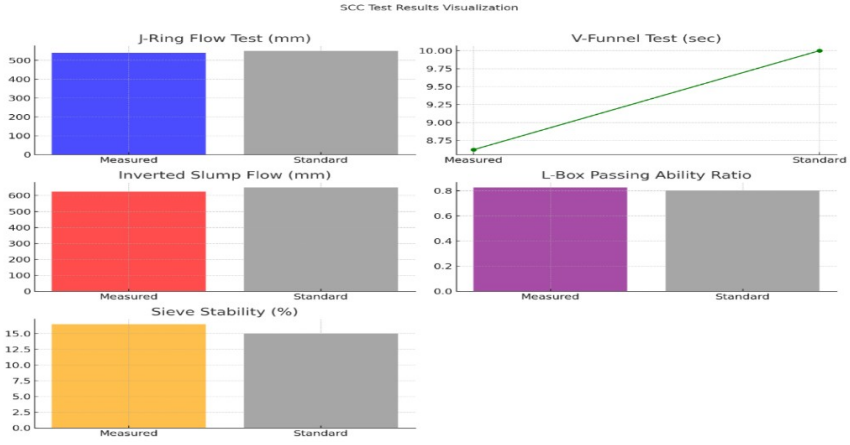


Figure 5 SCC Test Results

In case of J Ring test we find that when the fly ash content increased, flow diameter improved primarily but showed slight change at higher additions.

TABLE NO 1 J Ring flow at different Proportions of Fly Ash

Mix	Fly Ash (g)	J-Ring Flow (mm)
SCC	0g (without fly ash)	550 mm
SCC 1	5g	560 mm
SCC 2	10g	570 mm
SCC 3	15g	575 mm
SCC 4	20g	580 mm
SCC 5	25g	585 mm
SCC 6	30g	590 mm

We observeV-Funnel Test Time remained stable at medium levels but increased when fly ash content is higher this indicating an increase in viscosity. Shown in Table no 2

TABLE NO 2 V Funnel Test at different Proportions of Fly Ash

Mix	Fly Ash (g)	V-Funnel Time (sec)
SCC	0g (without fly ash)	8.62 sec
SCC 1	5g	8.4 sec
SCC 2	10g	8.3 sec
SCC 3	15g	8.5 sec
SCC 4	20g	8.9 sec
SCC 5	25g	9.3 sec
SCC 6	30g	9.8 sec

In case of Inverted Slump Flow Test we mainly find that diameter of spread is increased with fly ash content, indicating improved and better workability.

TABLE NO 3 Slump flow at different Proportions of Fly Ash

Mix	Fly Ash (g)	Slump Flow (mm)
SCC	0g (without fly ash)	625 mm
SCC 1	5g	635 mm
SCC 2	10g	645 mm
SCC 3	15g	655 mm
SCC 4	20g	665 mm
SCC 5	25g	670 mm
SCC 6	30g	675 mm

After test results author finds in case of L-Box Test The passing ratio increased slightly, indicating better flow and filling ability.

TABLE NO 4 L Box Ratio at different Proportions of Fly Ash

Mix	Fly Ash (g)	L-Box Ratio
SCC	0g (without fly ash)	0.826
SCC 1	5g	0.83
SCC 2	10g	0.85
SCC 3	15g	0.87
SCC 4	20g	0.89
SCC 5	25g	0.90
SCC 6	30g	0.91

Where asSieve Stability Test Segregation was abated at moderate levels but increased slightly at higher fly ash contents.

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TABLE No 5 Segregation In (%) at different Proportions of Fly Ash

Mix	Fly Ash (g)	Segregation (%)
SCC	0g (without fly ash)	15%
SCC 1	5g	12%
SCC 2	10g	10%
SCC 3	15g	9%
SCC 4	20g	11%
SCC 5	25g	13%
SCC 6	30g	14%

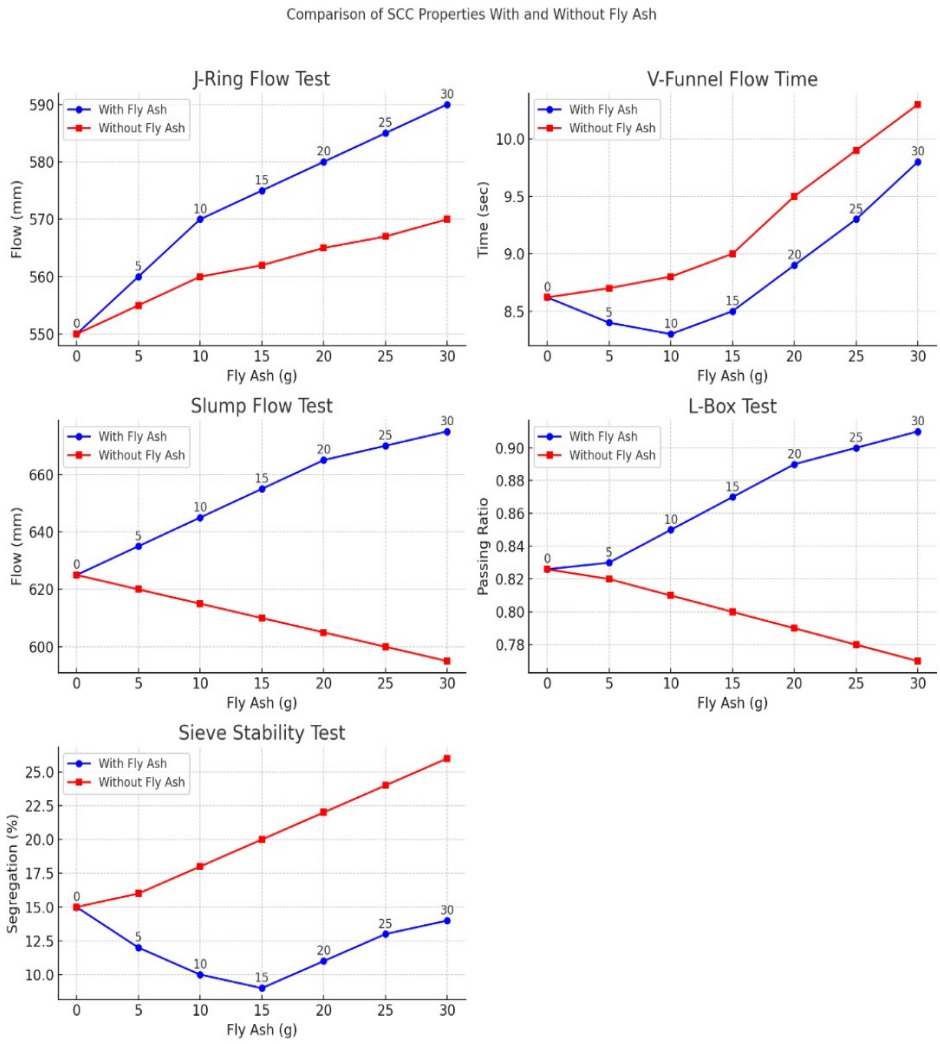


Figure No 6 Comparison of SCC Properties With and Without Fly Ash

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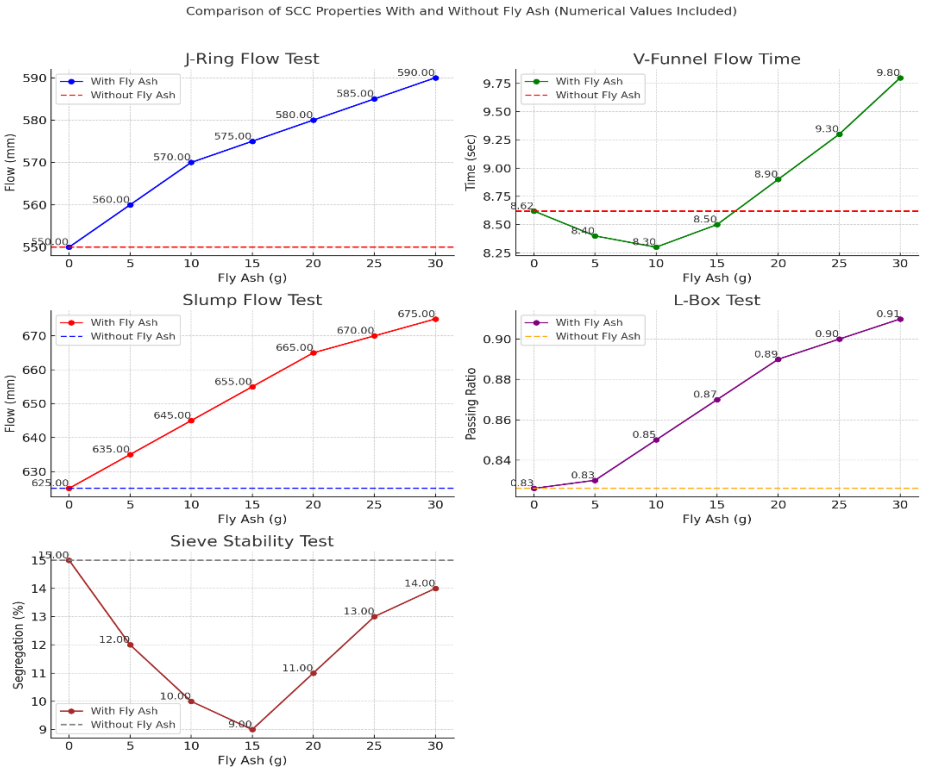


Figure No 7Comparison of SCC Properties With and Without Fly Ash(Having Numerical Values)

IV. CONCLUSION

Based on the experimental results, we came on the following conclusions:

1) *Workability Enhancement:* We concluded that after The J-Ring Test we finds that with increasing fly ash content it improves flowability also 10g–15g flyash is ideal for achieving a balanced flow without excessive segregation.
2) *Effect on Viscosity and Flow Time:* During analysis The V-Funnel Test showed that moderate fly ash content (up to 15g) having improved viscosity while preserving good flowability. However authors find beyond 20g, the flow time is increased It indicates a rise in mix viscosity.
3) *Improvement in Flow Spread:* During slump test we observe that Self Compacting Concrete with fly ash has a higher flow spread than without fly ash.
4) *Passing Ability of SCC:* Writers concluded that The L-Box Test results indicated that SCC with fly ash had a higher passing ability. We observe that The increase in the L-box ratio at higher dosages having improved flow through congested reinforcement.
5) *Segregation Resistance:* The Sieve Stability Test showed that moderate additions (10g–15g) of fly ash reduces segregation, ensuring a more stable mix. However, During Test analysis we find at higher fly ash dosages mainly (>20g), minor segregation issues were observed by us due to increased fineness and reduced cohesiveness.
6) *Optimal Dosage Recommendation:* Lastly we conclude The best overall performance of SCC was achieved with 10g–15g of fly ash, where the mix displayed high flowability, good passing ability, and minimal segregation.Alsowe find At higher dosages (>20g), the mix became more viscous that reduces overall flow but maintains better stability.

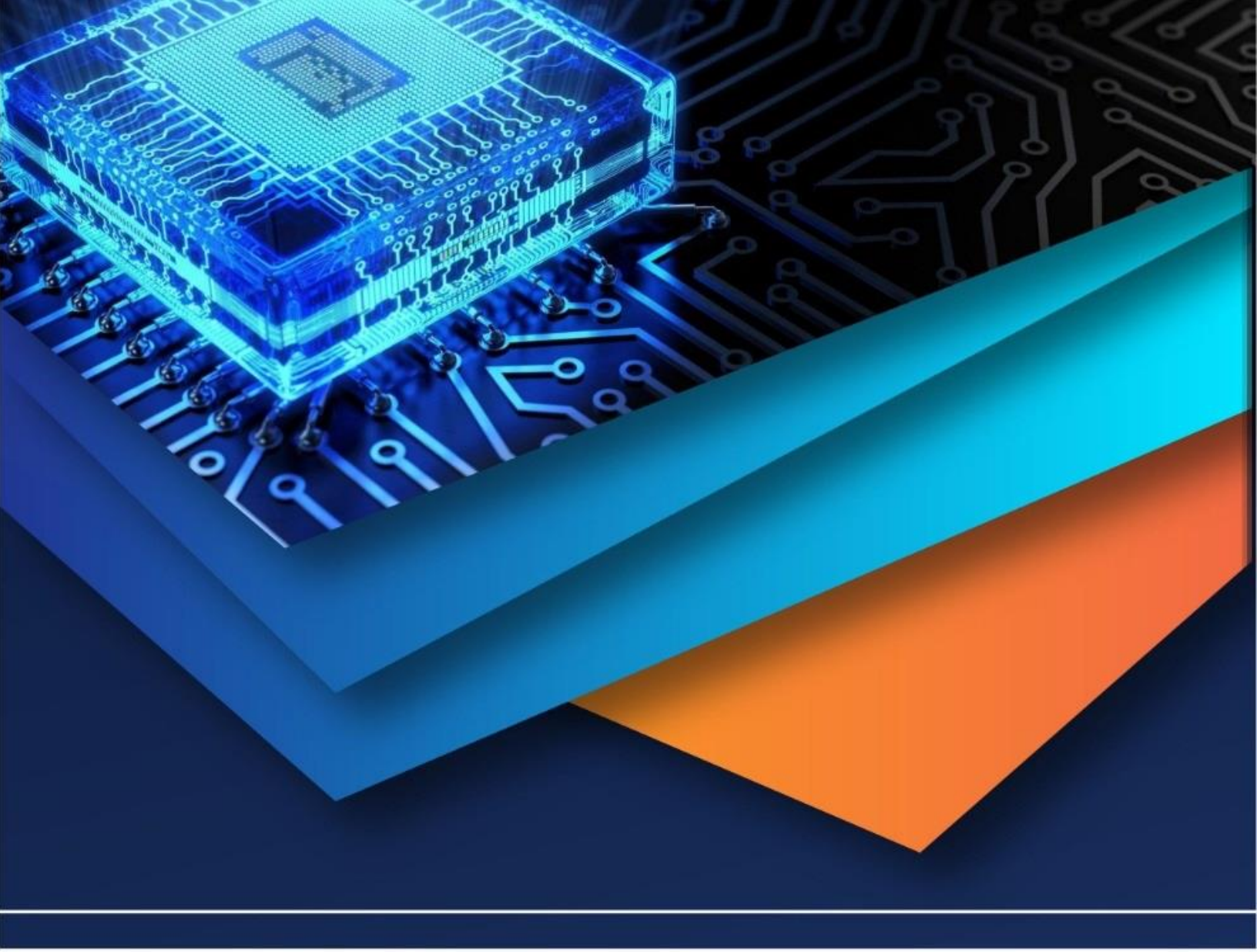
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