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Experimental studies on Concrete by Partial Replacement of Fine Aggregate with Glass Powder

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Abstract: ***The concrete industry is one of the largest consumers of natural resources, due to which the sustainability of a particular industry is threatened. The environmental and economic problem is the biggest problem facing a particular industry. In this paper, issues related to the environment and the economy is addressed through the use of waste glass as a partial replacement of thin units in concrete. Thin units were replaced by powder for waste glass in the form of 0%, 5%, 10%, 15%, 20% and 25% by weight for the mixture M-20. Concrete samples were tested for compressive strength, tensile strength, durability (water absorption) and density at the age of 28 days, and the results were compared with the results of ordinary concrete.***
Keywords: Glass, compressive strength, concrete and shrinkage

I. INTRODUCTION

Concrete is the most widely used building material made by man, and its demand is increasing every day. The use of river sand as a small unit leads to the exploitation of natural resources, lowering the water table, flooding of bridge piers and erosion of the riverbed. If a thin unit is replaced by used glass by a specific percentage and in a specific size range, it will reduce the fine aggregate content and thus reduce the bad effects of river dredging and thus make a particular manufacturing industry sustainable. The amount of waste glass produced has gradually increased in recent years due to the ever-increasing use of glassware.

Most waste is and is dumped in landfills. Garbage refueling is undesirable because waste glass does not decompose, which makes them less environmentally friendly. Using this waste is an hour. There is a huge potential for the use of waste glass in the concrete construction sector.

When the spent glasses are used to make concrete products, the cost of concrete production will decrease. This step will serve two purposes; first, it will be environmentally friendly; second, it will use waste instead of precious and relatively more expensive natural resources.

II. REVIEW OF LITERATURE

Dr.G. Prince Arulraj (2013) stated that reusing discarded liquid crystal display (LCD) of glass and adding it to concrete (RKDGC) to replace ordinary river sand with sand made from discarded LCD glass.

Three different designs of a mixture with the studied replacement of glass sand 0%, 15%, 20%, 25%, 30% and 40% were planned; after that, their engineering properties were determined.

Bharat Nagar et al (2016) investigated the properties of concrete containing waste glass as a fine aggregate. The strength and effect properties of alkaline silica (ASR) were analyzed in terms of the waste glass content. At that time, the total amount of 80 kg of crushed waste glass was partially replaced by sand by 10%, 15% and 20% in the concrete mixture.

Prerite sasena et al (2016) materials used in this research activity consist of cement, fine aggregate, coarse aggregate, waste glass and water. used glass was washed, ground and passed from a sieve of 325 microns. A total of 60 specimens were cast, retaining cement, fine aggregate and coarse population in a ratio of 1: 1.5: 3 of the binding water ratio is 0.5.

III. METHODOLOGY

1) *Cement:* Cement is a binder used for construction that is installed, solid and adjacent to other materials, tying them together. Cement is rarely used alone, but rather to bind sand and gravel (aggregate) together. Cement is used with a small unit to obtain a solution for laying or with sand and gravel units to obtain concrete. Cements used in construction are usually inorganic, often calcareous or silicate on the basis of calcium, and can be described as hydraulic or non-hydraulic, depending on the ability of the cement to be installed in the presence of water (see. Hydraulic and non-hydraulic lime plaster).

Table 1: Properties of Ordinary Portland cement

S.No.	Property	Test Results
1	Consistency	30%
2	Specific Gravity	3.125
3	Initial Setting Time	35 minutes
4	Final Setting Time	612 minutes
5	Fineness of Cement	3.6%

2) *Coarse Aggregate:* Those particles that are preferably kept at 4.75 mm (No. 4) sieve and pass through a 3-inch screen, called a rough unit. The rougher the unit, the more economical the mixture. Larger pieces offer a smaller particle surface area than the equivalent volume of small pieces. Using the maximum allowable size of the coarse unit reduces the need for cement and water. The use of units larger than the maximum size of permitted coarse units can lead to the blocking and formation of arcs or obstacles in concrete form.

Table 2: Sieve Analysis of Coarse Aggregate

IS Sieve No.	Weight Retained (Kg)	% Retained	Cumulative % Retained
80 mm	0	0	0
40 mm	0	0	0
20 mm	2.9	30	27
10 mm	6.3	60	89
pan	0.8	10	100
Total	10 Kg	100%	210%

3) *Fine Aggregate:* those particles that pass 9.5 mm (3/8 inch).) sieve, almost completely passes 4.75 mm (No. 4) sieve and preferably held at 75 µm (No. 200) sieve is called a small unit. To increase performance and economy, which is reflected when using less cement, the thin unit must have a round shape. The purpose of the subtle set is to fill the voids in the rough population and act as a performance agent.

4) *Glass Powder:* Amorphous glass (non-crystalline) and innocence, super chilled liquid, not solid. Glass can be made with excellent homogeneity in different shapes and sizes from small pieces of fiber meter. Primary glass consists of sand, calcined soda, limestone and other additives (Iron, Chrome, Alumina, Lead and Cobalt).Glass was used as units in road construction, building and masonry materials.

IV. RESULTS

From the experiment carried out following results are obtained:

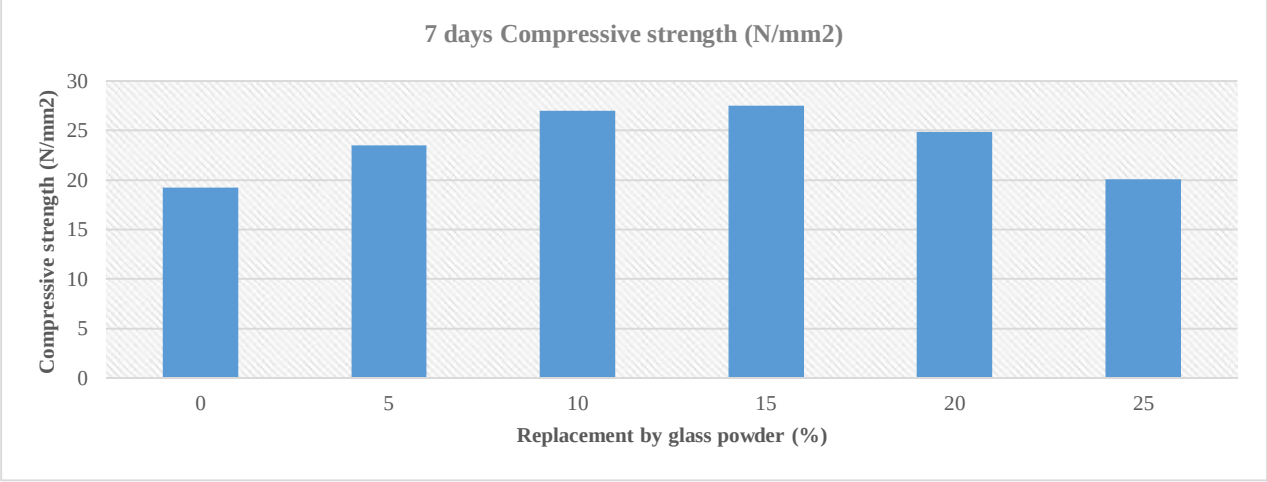

Fig.1: 7 days Compressive strength (N/mm2)

From the above figure it is observed that the 7 days Compressive strength is found to maximum for the case 10-15% replacement of fine aggregate by glass powder while the maximum value obtained is 27 N/mm^2.

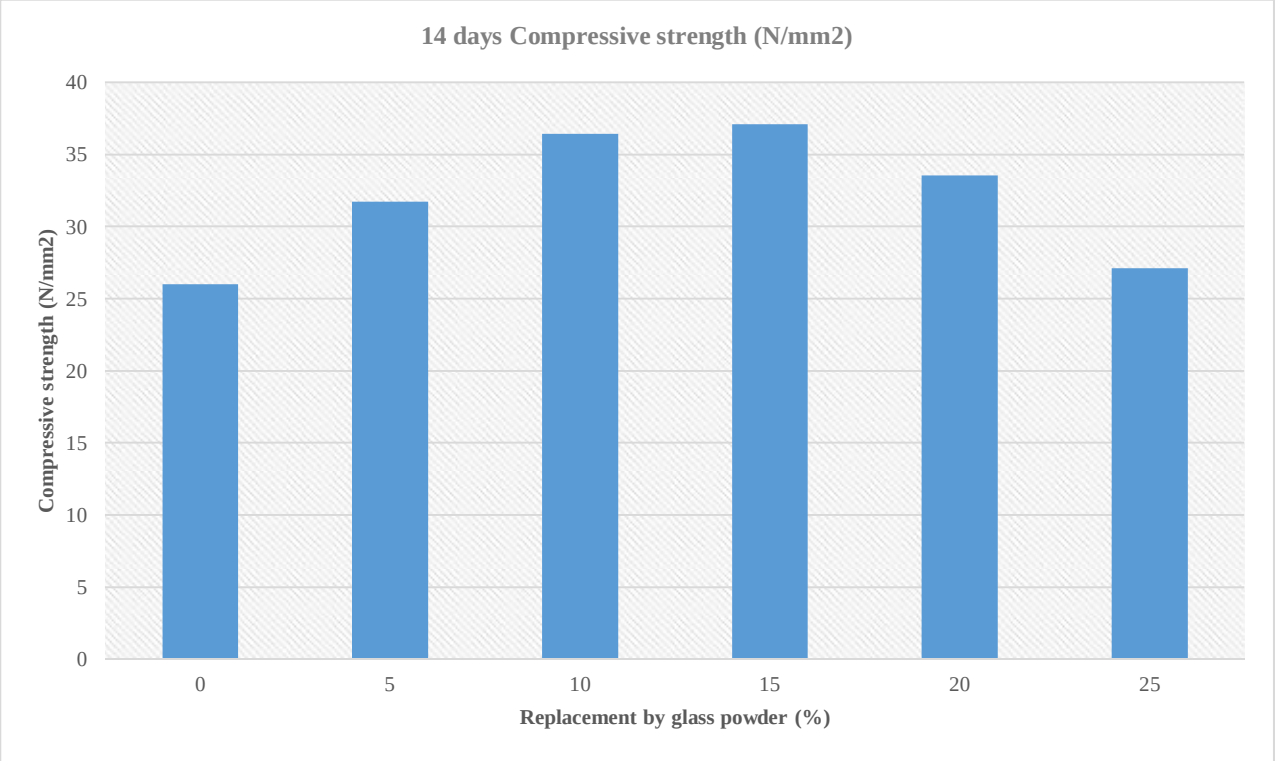

Fig.2: 14 days Compressive strength (N/mm2)

From the above figure it is observed that the 14 days Compressive strength is found to maximum for the case 10-15% replacement of fine aggregate by glass powder while the maximum value obtained is 37 N/mm^2.

Fig.3: 7 days Split tensile strength (N/mm2)

From the above figure it is observed that the 7 days Split tensile strength is found to maximum for the case 15% replacement of fine aggregate by glass powder while the maximum value obtained is 5.5 N/mm^2.

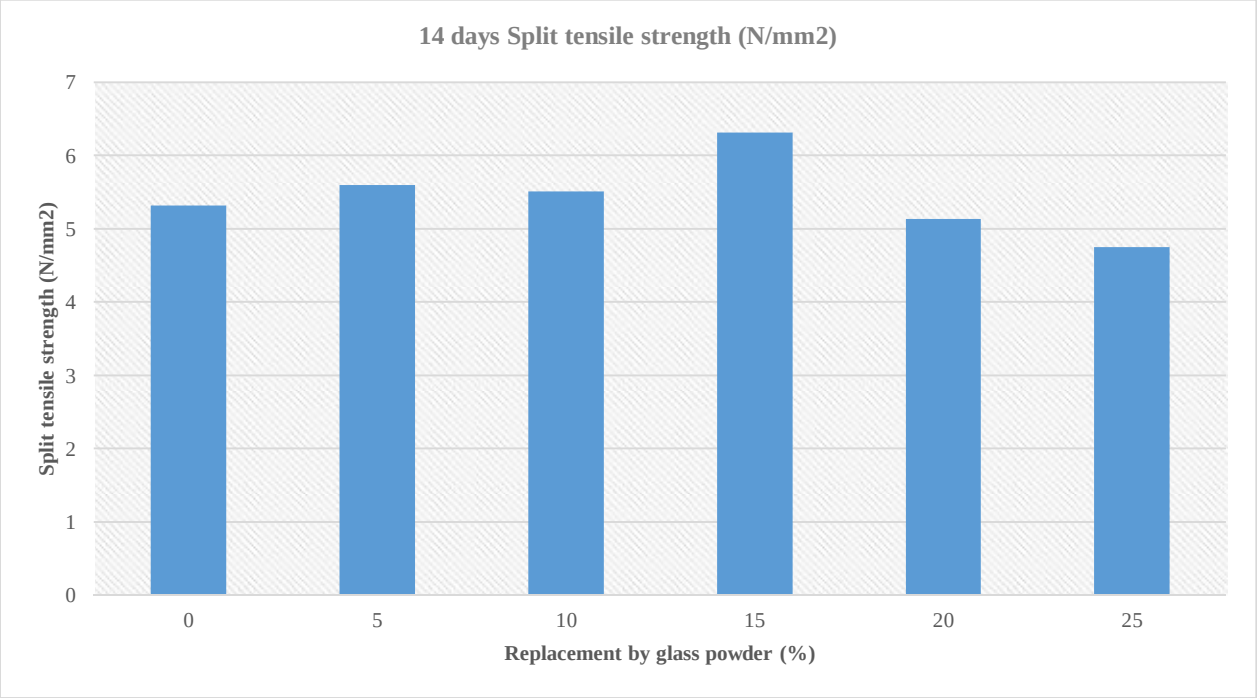

Fig.4: 14 days Split tensile strength (N/mm2)

From the above figure it is observed that the 14 days Split tensile strength is found to maximum for the case 15% replacement of fine aggregate by glass powder while the maximum value obtained is 6.5 N/mm^2.

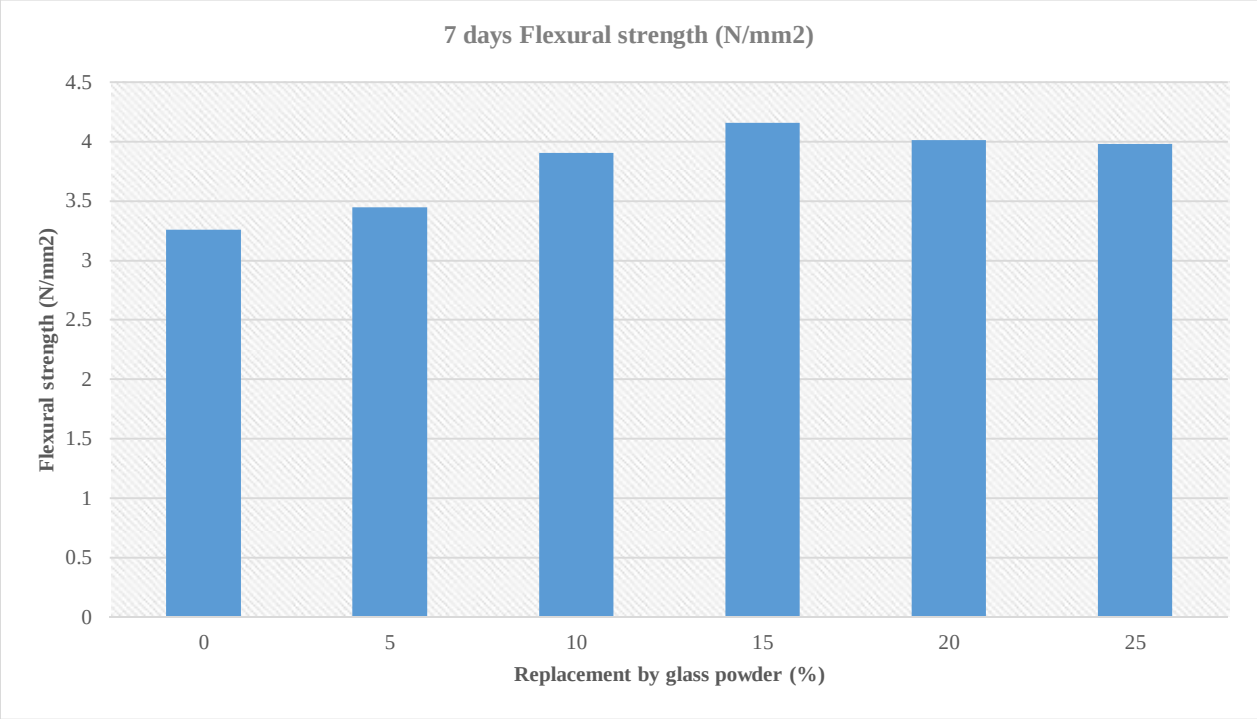

Fig.5: 7 days Flexural strength (N/mm2)

From the above figure it is observed that the 7 days Flexural strength is found to maximum for the case 15% replacement of fine aggregate by glass powder while the maximum value obtained is 4.1 N/mm^2.

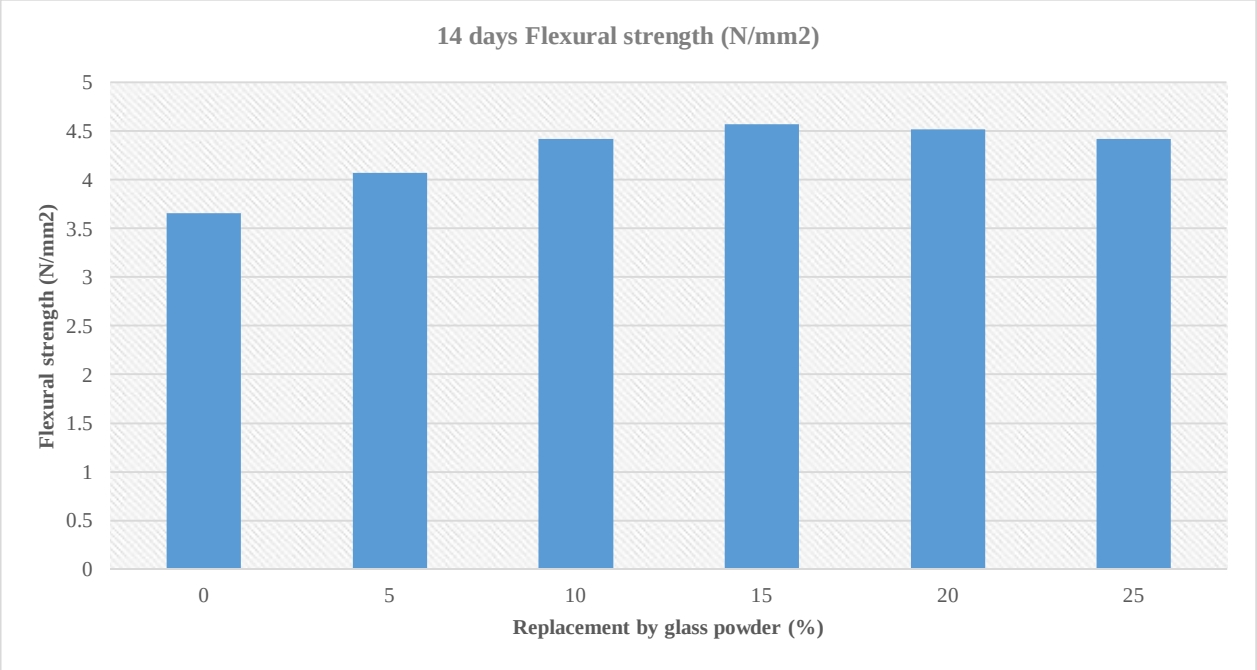

Fig.6: 14 days Flexural strength (N/mm2)

From the above figure it is observed that the 14 days Flexural strength is found to maximum for the case 15% replacement of fine aggregate by glass powder while the maximum value obtained is 4.5 N/mm^2.

V. CONCLUSION

The conclusions from the above study are as follows:

A. The From the above results it is observed that the 7 days Compressive strength is found to maximum for the case 10-15% replacement of fine aggregate by glass powder while the maximum value obtained is 27 N/mm2. Also it is observed that the 14 days Compressive strength is found to maximum for the case 10-15% replacement of fine aggregate by glass powder while the maximum value obtained is 37 N/mm2.

B. From the above results it is observed that the 7 days Split tensile strength is found to maximum for the case 15% replacement of fine aggregate by glass powder while the maximum value obtained is 5.5 N/mm2. Also it is observed that the 14 days Split tensile strength is found to maximum for the case 15% replacement of fine aggregate by glass powder while the maximum value obtained is 6.5 N/mm2.

C. From the above results it is observed that the 7 days Flexural strength is found to maximum for the case 15% replacement of fine aggregate by glass powder while the maximum value obtained is 4.1 N/mm2.

D. From the above results it is observed that the 14 days Flexural strength is found to maximum for the case 15% replacement of fine aggregate by glass powder while the maximum value obtained is 4.5 N/mm2.

E. From the above it can be concluded that the maximum replacement of fine aggregate is allowed upto 15% for the case of glass powder.

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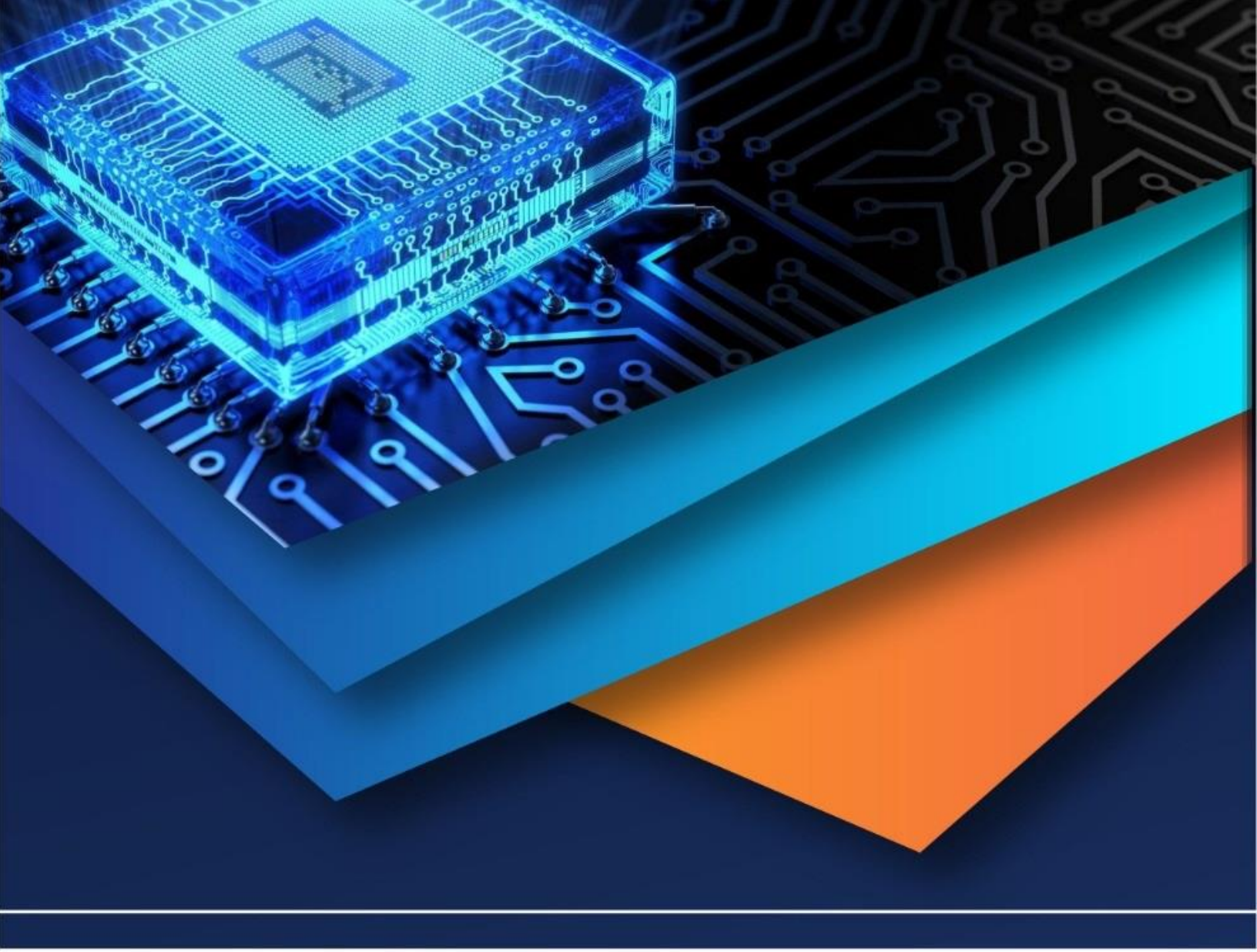

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