iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VIII **Month of publication:** August 2022

DOI: https://doi.org/10.22214/ijraset.2022.46416

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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 10 Issue VIII Aug 2022- Available at www.ijraset.com

An Experimental Analysis as Replacement of Natural Sand with Bamboo Fibre and M-Sand in Concrete

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SIRTS

Abstract: ***In the present world, concrete has become a significant piece of the development business and the materials which are utilized in causing cement to have advanced because of better nature of concrete and better evaluation of coarse totals. The sand is a significant piece of cement. It is for the most part secured from regular sources. Along these lines the evaluation of sand isn't heavily influenced by us. The solid blocks of M-25 evaluation were tossed right now investigate work and attempted to break down various properties of solid like compressive quality, usefulness and so on. Right now, M-sand (Manufactured sand) is considered as a substitution of characteristic sand by 50, 70 and 90% by weight of sand in solid plan blend in with 5% Bamboo fiber streams as an admixture. This investigation is done at the age of 7, 14, 21 and 28 days restoring of solid shapes and shafts. Right now, general properties of new and solidified cement were attempted and the results were dismembered. As concrete is a focal material for the development business. Right now is seen that the M-sand fundamentally increased the compressive strength of cement with most extreme qualities. Bamboo fiber helps in improving solid properties to maintain a strategic distance from breaks and disappointment. There is an altogether expanded in the compressive quality of 3D squares as we expanded the level of M-sand to 50%,70% and 90% compressive quality increments as 25.1, 26.4, 27 N/mm2 separately for 28 days of curing. There is likewise expanded in the flexural strength of the beam as we expanded in the level of M-sand to 50%, 70% and 90% flexural strength increments as 5.5, 7.02 and 12.9 N/mm2 separately for 28 days of curing.***
Keywords: Concrete; Compressive strength; Flexural strength; Curing; M-sand; Bamboo fibre;

I. INTRODUCTION

A. *General*

It is all around perceived that fine total assumes a significant job in concrete. Fine total commonly involves more than 33% of the volume of cement, and research demonstrates that adjustments in properties of fine total (sand) can change the quality and crack properties of cement. To foresee the conduct of cement under general stacking requires a comprehension of the impacts of sand type, sand properties, and blend admixture. This comprehension must be increased through broad testing and perception.

The general functional money related improvement, proficiency, and the thriving of a nation rely vivaciously upon the helpfulness, faithful quality, and strength of its manufactured workplaces. In any case, aside the regular and operational condition, theconstituent materials speaking to the growing occasions of essential inadequacy and useful obsolete nature are recorded in the built condition.

This investigation depicts work that is planned for improving the comprehension of the job of assembling sand in concrete. The factors considered are producing sand, blend of characteristic and assembling sand, Bamboo fiber whose length may shift from 1 to 2 inch for example (25 to 50 mm).

Since regular filaments are normally accessible materials, they are not uniform in distance across and length. The measurement is changed from 0.004 to 0.03 in. We are utilizing Bambusa vulgaris types of bamboo for the throwing of solid shapes and bars. In ordinary and high- quality cements pressure, flexural, and break tests are utilized to all the more likely comprehend the impacts sand type have in concrete. For near investigation we are thinking about 150 x 150 x 150 mm 3D square example and 300 x 200 mm x 600 mm pillar areas.

B. *Admixtures*

Plasticizer, Super plasticizer, Retarder and impeding admixtures, Accelerators and quickening plasticizers, Air entraining admixture, Pozzolanic or mineral admixture, Water sealing and soggy sealing admixtures, Gas shaping admixture, Air detraining admixture, Alkali total development restraining admixtures.

C. M-Sand

Produced sand is an option for stream sand. Because of quickly developing development industry, the interest for sand has expanded colossally, causing insufficiency of reasonable waterway sand in most piece of the word.

Because of the exhaustion of good quality waterway sand for the utilization of development, the utilization of produced sand has been expanded. Anotherexplanation behind utilization of M-Sand is its accessibility and transportation cost.

Since fabricated sand can be squashed from hard stone rocks, it very well may be promptly accessible at the close by place, diminishing the expense of transportation from distant waterway sand bed.

In this way, the expense of development can be constrained by the utilization of produced sand as an elective material for development. The other preferred position of utilizing M-Sand is, it tends to be sans dust, the extents of m-sand can be controlled effectively with the goal that it meets the necessary reviewing for the given development.

Figure 1 Manufactured Sand

D. Advantages of Manufactured Sand

1) It is all around evaluated in the necessary extent.

2) It doesn't contain natural and dissolvable intensify that influences the setting time and properties of concrete, accordingly the necessary quality of cement can be kept up.

3) It doesn't have the nearness of debasements, for example, dirt, residue and sediment coatings, increment water prerequisite as on account of stream sand which hinder bond between concrete glue and total. Subsequently, expanded quality and sturdiness of cement.

4) M-Sand is gotten from explicit hard rock (stone) utilizing the cutting-edge international innovation, in this manner the necessary property of sand is acquired.

5) M-Sand is cubical fit as a fiddle and is made utilizing innovation like High Carbon steel hit shake and afterward ROCK ON ROCK process which is synonymous to that of regular procedure experiencing in waterway sand data.

6) Modern and imported machines are utilized to create M-Sand to guarantee required reviewing zone for the sand.

E. Benefits of M sand in construction Industry

1) *Durability of Concrete:* Since produced sand (M-Sand) is handled from chosen nature of rock, it has the fair physical and concoction properties for development of solid structures. This property of M-Sand enables the solid structures to withstand extraordinary ecological conditions and forestalls the erosion of fortification steel by decreasing porousness, dampness entrance, freeze-defrost impact expanding the strength of solid structures.

2) *Usefulness of Cement:* Size, shape, surface assume a significant job in usefulness of cement. With progressively surface zone of sand, the interest for concrete and water increments to bond the sand with coarse totals. The command over these physical properties of assembling sand makes the solidrequire less measure of water and give higher serviceable cement. The less utilization of water likewise helps in expanding the quality of concrete, less exertion for blendingand position of cement and along these lines builds profitability of development exercises at site.

3) *Less Construction Defects:* Development absconds during arrangement and post-cementing, for example, isolation, dying, honeycombing, voids and capillarity in concrete gets diminished by the utilization of M-Sand as it has ideal starting and last setting time just as incredible fineness.
4) *Economy:* As talked about above, since use of M-Sand has expanded toughness, higher quality, decrease in isolation, porousness, expanded functionality, diminished post-solid imperfections, it ends up being efficient as a development material supplanting streamsand. It can likewise spare transportation cost of stream sand by and large.
5) *Eco-Friendly:* Use of made sand forestalls digging of stream beds to get waterway sand which may prompt natural fiasco like ground water consumption, water shortage, danger to the security of extensions, dams and so forth to make M-Sands more eco-accommodating than stream sand.

F. Bamboo Fiber

Bamboo develops in the tropical and subtropical territory. Because of the less expensive cost, bamboo houses can be worked for individuals on the planet. In view of the effective development of bamboo houses, organizations and specialists has watched for utilizing bamboo as basic component of development, for example,bamboo fortified cement. Bamboo plants can possibly create of advancement indevelopment. A few examinations have been completed on the utilization of crude bamboo as strengthening material to supplant regular steel. As a rule, bamboo was utilized for development and home goods. Bamboo pieces were utilized for toothpicks, sticks, and the wicker. This furniture fabricating process produces squander as bamboo fiber. In this way, bamboo fiber will be watched for fixing splits in concrete

Bamboo fiber is a recovered cellulosic fiber delivered from bamboo. Boring mash is delivered from bamboo stems and leaves through a procedure of soluble hydrolysis and multi-stage blanching. Further compound procedures produce bamboo fiber.

Rehashed innovative investigation has demonstrated that this sort of fiber has aslenderness degree furthermore, whiteness degree near ordinary finely dyed gooey and has a solid solidness, security and steadiness.

Bamboo fiber texture is made of 100% bamboo mash fiber. It is described by its great hygroscopicity, great porousness, delicate feel, effectiveness to fix and color and impressive shading impact of pigmentation. Strands are known to fundamentallyinfluence the free shrinkage and other early-age properties of concrete-based composite. Fiber-strengthened cement is commonly made with a high concrete substance and low water/concrete proportion. The proficiency of all fiber fortification is endless supply of a uniform dispersion of the filaments in the solid. Steel fiber requires incredible measure of vitality to deliver and is costly. In many creating nations, because of their restricted assets, steel isn't reasonable. Be that as it may, bamboo is more affordable and increasingly feasible to keep up. On account ofcellulose strands, both covered and uncoated filaments are powerful just at doses above 0.3% by volume.

Figure 2 Bamboo fiber

G. Problem Identification

Concrete is a most basic used material in human life in light of the fact that all accommodating planning structures are created with concrete. In transportation for themost part unbendable black-tops are laid by concrete. Because of its fast usagenumerous numbers of asks about are jumping out at improve the properties of cement and to prescribe replaceable materials for concrete. The essential inspiration driving this assessment is to prescribe the locally open materials (Which are eminent to people like fiber and m sand stick soot) to improve the properties of cement furthermore, to diminish the expense of advancement. Properties improved in the midst of the tests are setting time, functionality, compressive nature of cement. In a couple of countries, including Pakistan, higher summer temperatures, low familymember in a city and sweltering breeze blowing cause fast scattering of water from the fresh solid surface. In this way solid sets earlier and no real time is left open for solidifying tasks. For example, it has been represented that, at the point when the temperature of bond mortar met a water/solid (w/c) extent of 0.6 is extended from 27.80C to 45.50C both the hidden and last setting conditions are nearly part. Advance issues moreover rise, for instance, brisk decrease of droop, improvement of crispjoints and plastic shrinkage parts, extended difficulty in air entrainment, improved vulnerability and reduced strength, disintegration of steel, what's more, decline in extraordinary nature of cement. With a particular ultimate objective to give fittingtime to solidifying activity, especially when unavoidable deferrals among mixing and putting occur, and to save concrete from other badly arranged effects of opposing climatic conditions, bond set block/or usage of hindering admixtures.

Right now, the methods by which to construct the properties of cement with most likely comprehended and easily available materials, so that can make a productive advancement. For growing the usefulness of cement there is imperative to construct the water content in the solid. It realizes reducing the nature of cement. So consequently, there is need to incorporate an admixture which assembles the usefulness of concrete without decreasing the quality. Retarders are used as a piece of the solid blend to improve the setting time and besides to assemble the temperature of the creation with different sort of admixtures. Concrete made with admixtures like bamboo filaments can be utilized explicitly conditions. Usage of these admixtures willdecrease the seclusion and biting the dust.

H. Objectives

Following are the main objectives of our study are as follow:

1) Following are the main objectives of our study:
2) Determination of m-sand use in place of natural sand to stopenvironmental hazard.
3) Determine compressive strength of concrete with varying percentage of m-sand replacing of natural sand.
4) To establish a proper mix of m-sand and fiber for its future implementationon field
5) To determine the cost effectiveness & availability of manufacturing sandover natural sand.

II. MATERIALS PROPERTY & DESIGN MIX

A. Water Cement Ratio

The water – concrete proportion is the heaviness of water to the heaviness of concrete utilized in a solid blend. A lower proportion prompts higher quality and toughness, yet may make the blend hard to work in with and structure. Functionality can be settled with the utilization of plasticizers or super plasticizers. The proportion alludes the proportion of water to solidify in addition to pozzolan proportion, w(c+p). The pozzolan is ordinarily a fly debris, or impact heater slag. It can incorporate various different materials, for example, silica rage, rice husk debris or regular pozzolans. Pozzolans can be added to reinforce concrete. A blend in with a proportion of 0.35 may not blend altogether, and may not stream all around ok to be put. More water is subsequently utilized than is in fact important to respond with concrete.

Water- concrete proportions of 0.45 to 0.60 are all the more normally utilized. For higher quality solid, lower proportions are utilized, alongside a plasticizer to build stream capacity. Concrete solidifies because of the substance response among concrete and water (known as hydration), this produces heat and is known as the warmth ofhydration to much water will bring about isolation of the sand and total parts from the concrete glue. An overabundance of water will realize detachment of the sand and total parts from the concrete paste.

Moreover, water that isn't eaten up by the hydration reaction may leave concrete as it cements, realizing minor pores (biting the dust) that will decrease last quality of cement. A mix with a great deal of water will experience more shrinkage as wealth water leaves, achieving internal parts and recognizable splits (particularly around inside corners), which again will diminish the last quality.

Advantages of low water/cement ratio:

1) Increased strength
2) Lower permeability Increased resistance to Weathering Increased resistance to weathering
3) Better bond between concrete and reinforcement
4) Reduced drying shrinkage and cracking
5) Less volume change from wetting and drying

B. Aggregate in Concrete

Total are basic part in concrete. The offer body to the solid, decline shrinkage sway economy. These messed up pieces might be adjusted, precise or roundabout fit as a fiddle. Total are accessible on numerous erratic shapes and very ruff material. It is a tolerable holding material. To discover even more about the solid is significant that one must to discover even more about the total which make up genuine volume in concrete. The essential components of total in concrete are to settle the estimations of the solid part by diminishing the volumetric changes as a result of drying shrinkage ofthe bond water glue in solidified cement, to lessen the warmth of hydration, and to go about as a filler material to oversee in the usage of cement. Since total is a significant vital piece of solid, its characteristics basically impact the functionality of crisp solid, sturdiness, quality, warm properties and unit weight of solidified cement. Right now, total of sizes 20 mm and 10 mm were utilized. The particular gravity of coarse total was 2.72 for both the divisions. The sifter examination of 20 mm and 10 mm.

Total is shaped by the deterioration of existing rocks by enduring activity either by wind, water or icy masses. These wrecked pieces might be adjusted, precise orroundabout fit as a fiddle. Total are the significant constituents in concrete. They offerbody to the solid, lessen shrinkage and impact economy. Prior, totals were considered as synthetically dormant material however now it has been perceived that a few totals are artificially dynamic and shows a substance bond among total and glue.

To find out about the solid is basic that one should find out about the total which establish significant volume in concrete. The principal elements of total in concrete are: to balance out the elements of the solid part by lessening the volumetric changes due to drying shrinkage of the concrete water glue in solidified cement, to decreasethe warmth of hydration, and to go about as a filler material to conserve in the utilization of concrete.

Concrete is the most generally utilized development material, where coarse and fine totals are filler material and concrete glue is restricting material. The properties of cement and functionality of cement relies on the total. Concrete is one of the main development materials accessible today. Concrete is composite of sand, rock, squashed stone, or other total held together by a solidified glue of pressure driven concrete and water. Concrete has discovered use in a wide range of development structure parkway, channel, scaffold, and dams to the most lovely and imaginative of structures.

It is made by blending coarse and fine totals, water, concrete, and added substances ina specific recommended extent. Total is one of the primary fixings in concrete. It covers more than 60-75% of the absolute volume of any solid blend. In certain circumstance, blend will be added to satisfy the attribute of cement to be accomplished. A decent nature of cement is straightforwardly identified with the high caliber of material utilized in blending process. In development regularly the usefulness, solidness and quality of solid will be the main trademark that will concentrate on to guarantee the great outcome in development. Solidified cement can be acquired by the substance response between material in blending concrete.

Quality of solid will increment because of the time of solid itself. Most of thecementation's fastener utilized in concrete depends on Portland concrete clinker which is a vitality concentrated procedure.

C. Physical Properties of Aggregate

The physical properties of totals incorporate explicit gravity, porosity, assimilation limit, dampness content, unsoundness because of volume changes and warm properties and need an investigation.

1) *Specific Gravity:* Explicit gravity of totals is utilized in plan counts of cement blends. Its weight can be changed over into strong volume and hence a theoretical yield of cement per unit volume can be determined. The weight per unit of volume of a substance makes the thickness while explicit gravity is the extent of the thickness of the substance to the thickness of water. Normal explicit gravity of rocks 2.6 to 2.8.
2) *Strength and Elasticity:* The quality of a total is estimated similarly as its ability to proceed with powers that may push or pulverize while it is being used. Flexibility suggests how much the atom can expand. Strange measures of both these properties are required in the base and surface. The rate at which the solid weakens is restricted while the constancy of the compacted material is helped by these properties.

3) *Hardness of the Total:* The obstruction of the total to scratched spot and corruption is constrained by the hardness of the minerals which the total particles are contained and the strength with which the grains of the particles are built up or darted together. Minerals that have a low degree of hardness structure fragile total particles.
4) *Shape of the Particles:* The condition of the total particles impacts the usefulness and quality of both Portland bond concrete and hot dark top mixes. It moreover influences how a lot dark top is required for the mix. Crushed stone or beat rock are believed to be the best sorts of totals to use for quality. Right when beat totals that have sporadic or saucy particles are used, they interlock or tie closer when they are compacted or joined.

Table 1 Physical properties of aggregate

	Coarse Aggregate	
Sr. no.	Physical Properties	Aggregate
1.	Water Absorption %	1.56
2.	Specific Gravity	2.63
3.	Bulk Density (kg/m3)	1325.94

The aggregates which stayed on 4.75mm IS Sieve is called coarse aggregates, coarse aggregate is uncrushed rock or stone which comes about because of the normal breaking down of rocks, squashed rock or stone when it comes about because of pounding of rock or hard stone.
Coarse aggregate which is utilized as a part of concrete cube shape is affirmed by IS383. Beyond what many would consider possible squashed semi pounded aggregates should be utilized. For guaranteeing sufficient solidness, the aggregate utilized for generation of pieces should be sound and free of delicate or nectar brushed particles.
Other sort aggregates, for example, slag and smashed and, over consumed block or tile which might be discovered reasonable with respect to quality, sturdiness of concrete and opportunity for unsafe impacts might be utilized as a part of arrangement of concrete for generation of concrete cube specimen. However, such aggregates should not contain more than 0.5 % of sulfates as SO3 and might not retain over 2% of their own mass of water.

D. Fine Aggregate (Sand)

Aggregate which go from 4.75 mm strainer and contains just so significantly coarser material as allowed, fine aggregate is regular sand which is coming about because of the normal deterioration of shake and which has been saved by streams or icy organizations, it is additionally squashed stone sand which is delivered by pounding hard stone, it is likewise pulverized rock sand which created by smashing common rock.
Sand, rock, residue and dirt are for the most part results of all common and simulated breaking down of shake sand minerals. Sand is acquired from frosty, stream,lake, marine, lingering, and wind-blown (fine sand) stores. It is recognized from rock and residue on the premise of molecule measure: grains from (159 mm) through in 6.35mm in breadth are classed as sand, those less than159 mm as sediment, and those bigger than (6.35 mm) as rock. The measure of fine aggregate is affirming to IS: 383-1970.

E. Cement

Cement, a popular binding material, is a very important civil engineering material. This article concerns the physical and chemical properties of cement, as well as the methods to test cement properties.
Portland pozzolana cement can be created either by crushing together Portland cement clinker and pozzolana with expansion of gypsum or calcium sulfate, or been personallyand consistently mixing Portland cement and fine pozzolana. While granulating of the two materials together introduces no trouble, the blending of dry powders personally isto a great degree trouble the mixing strategy should, accordingly, be depended on just when the crushing technique is unthinkable or demonstrates uneconomical in a specific case. Where mixing strategy is received, each care ought to be taken to see that the mixing is as close as could be expected under the circumstances. Portland pozzolana cement can for the most part be utilized wherever 33review customary Portland cement is usable under ordinary condition.
In the present work locally available Portland Pozzolana Cement (fly ash based) brand name Birla Gold confirming to IS 1489 (Part-1)-1991 is used. The properties of this cement is as follows:

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VIII Aug 2022- Available at www.ijraset.com

F. Design Mix

The solid mix configuration is a system of picking the fitting components of concrete and choosing their most perfect degrees which would convey, as monetarily as could be normal in light of the current situation, solid that satisfies the action requirements, for example the solid having a particular least compressive quality, the desired usefulness and durability. Not with standing these requirements, the concrete substance in the mix should be as low as possible to achieve most prominent economy. The proportioning of the components of cement is a basic bit of solid development as it ensures the quality and economy. The compressive quality of set solid which is generally thought to be a record of its various properties, depends on numerous components, for example quality and measure of concrete, water and totals; batching and blending; putting, compaction and restoring. The expense of cement is contained the expense of materials, plant and work. The assortments in the expense ofmaterials rise up out of how the concrete is a couple of times extreme than the total, thusly the fact is to convey as lean a blend as could be permitted. From particular point of view the rich blends may incite high shrinkage and parting in the helper concrete, and to headway of high warmth of hydration in mass solid which may cause breaking.

1) *Principal of Concrete Mix Design:* Proportioning of a solid mix incorporates choosing the overall proportions of materials to be utilized in progress of cement for a gave limit. The path towardpicking degrees of these materials is designated "Solid Mix Design" and should not be misjudged with helper plan. Proportioning may be established on explicit data got by sensible experience and assessments of test outcomes of various fixings or careful data. The central difference in proportioning cement or mortar blends is the period of an extreme material of essential quality, water comfort, and other crucial properties in any occasion cost. To fulfill these goals, careful thought must be given to the decision of bond, total, what's more, water to the running with examinations.
2) *The Concrete Mix Design Standards:* The system of mix configuration incorporates the idea of properties and costs of fixings. Essentials of setting and finishing the new concrete and properties of set cement, for instance, quality, sturdiness, and volumetric relentlessness thus forward. The standard goals of the solid mix configuration would in this way have the option to be started as age of solid, which may be:
3) *Usefulness of Plastic Stage Concrete:* Wanted quality and solidness of established solid which thusly is addressed by water-bond degree law. Conditions at the site, which helps in picking usefulness, quality and solidness necessities. The compressive idea of set solid which is for the most part thought to be a once-over of its differing properties, relies upon various portions, ex: proportion of bond, water and totals; gathering and blending; setting, compaction and restoring.

G. Design Mix for Various Evaluations

Blend plan M25 Grade planned according to IS 10262:2009 and IS 456:2000. Blend proportioning for a solid of blend grade is given in 1 and 2.

1) Stipulations For Proportioning

a) Grade assignment: 25
b) Type of concrete: OPC 43 Grade adjusting IS 12269
c) Maximum ostensible size of total: 20mm
d) Minimum concrete substance: 300 kg/m (IS 456:2000)
e) Maximum water-concrete proportion: 0.50 (Table 5 of IS 456:2000)
f) Workability: 100-120mm droop
g) Exposure condition: Moderate (For Reinforced Concrete)
h) Degree of supervision: Good
i) Type of total: Crushed Angular Aggregates

2) Test Data For Materials

a) Cement utilized: OPC 53 Grade accommodating IS 12269
b) Specific gravity of concrete: 3.15
c) Specific gravity of

- Coarse total: 2.734
- Fine total: 2.53

d) Aggregate

- Coarse total: Conforming to all in totals of Table 2 of IS 383
- Fine total: Conforming to Grading Zone II of Table 4 of IS 383

III. METHODOLOGY & EXPERIMENTAL SETUP

A. Methodology Adopted

1) Collect material Samples from site and crushers.
2) Ordinary Portland cement is to be use. The aggregates which comprise riversand and crushed granite of 20 mm maximum nominal size was used.
3) Mixed at a water-cement ratio of 0.45.
4) Materials are mixed properly.
5) Testing should be done after curing for 7,14- and 28-days samples.
6) Testing should be done after curing for 7,14- and 28-days samples.
7) Labelling of cubes and beams as per curing duration.
8) Performing Tests in college laboratory.
9) Values checked by guide and supervisors.

Figure 3 Sample Prepared with M-sand and Bamboo fiber

Figure 4 Casting of Cubes and Beams

Figure 5 Curing of Samples

Figure 6 UTM test

B. Experimental Work

(table for percentage of material added)

Table 2 Percentage of fiber replacing cement

Percentage of composite material added			
Sunol.	Material	% (by weight)	Replacing
1	M sand	0, 50, 70 & 90 %	Sand
2	Bamboo fiber	5 %	Cement

C. Universal Testing Machine

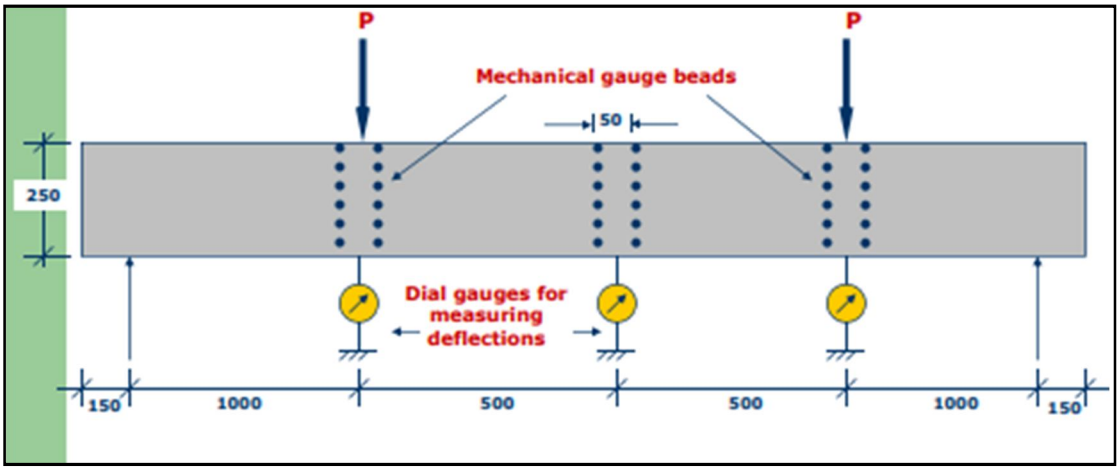

Figure 7 UTM setup

Impact test on coarse aggregates by impact testing machine

Figure 8 Arrangement of test

IV. EXPEROMENTAL RESULTS & DISCUSSION

A. Sieve Analysis & Fineness Modulus

Compressive Strength of Mix Cubes

Comparative results for 7, 14, 21 & 28 days curing of cubes Table 3 Compressive Strength of M-25 mix cube (N.mm^2)

Compressive strength of M-25 mixes. Cube (N/mm^2)				
Days/% of replacement ofnatural sand with M-sand	0% M-sand	50% M-sand	70% M-sand	90% M-sand
7 day of curing	15.5	15.9	16.3	16.7
14 days of curing	22.8	23.25	23.7	23.95
21 days of curing	23.1	23.5	23.9	24.05
28 days of curing	24.3	25.1	26.4	27

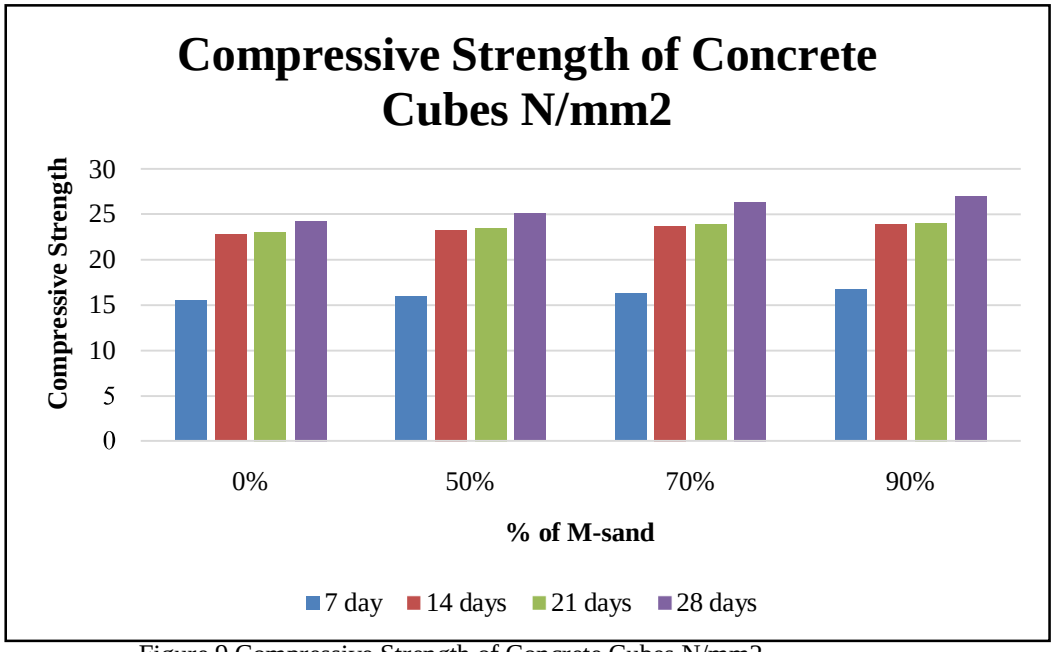

Figure 9 Compressive Strength of Concrete Cubes N/mm2

B. 7 days Curing Test Results of Beam

Table 4 Flexure Strength and Failure Load of Beams

Beam	First crack load, Fc (KN)	Ultimate load failure,Fu (KN)	Fc/Fu	Flexural Strength (N/mm^2)
0 % M-Sand	7	7.5	0.575758	3.21
50 % M-Sand	9.8	12	0.666667	5.45
70 % M-Sand	12	18	0.732	6.4
90 % M-Sand	19	33	0.933333	12.1

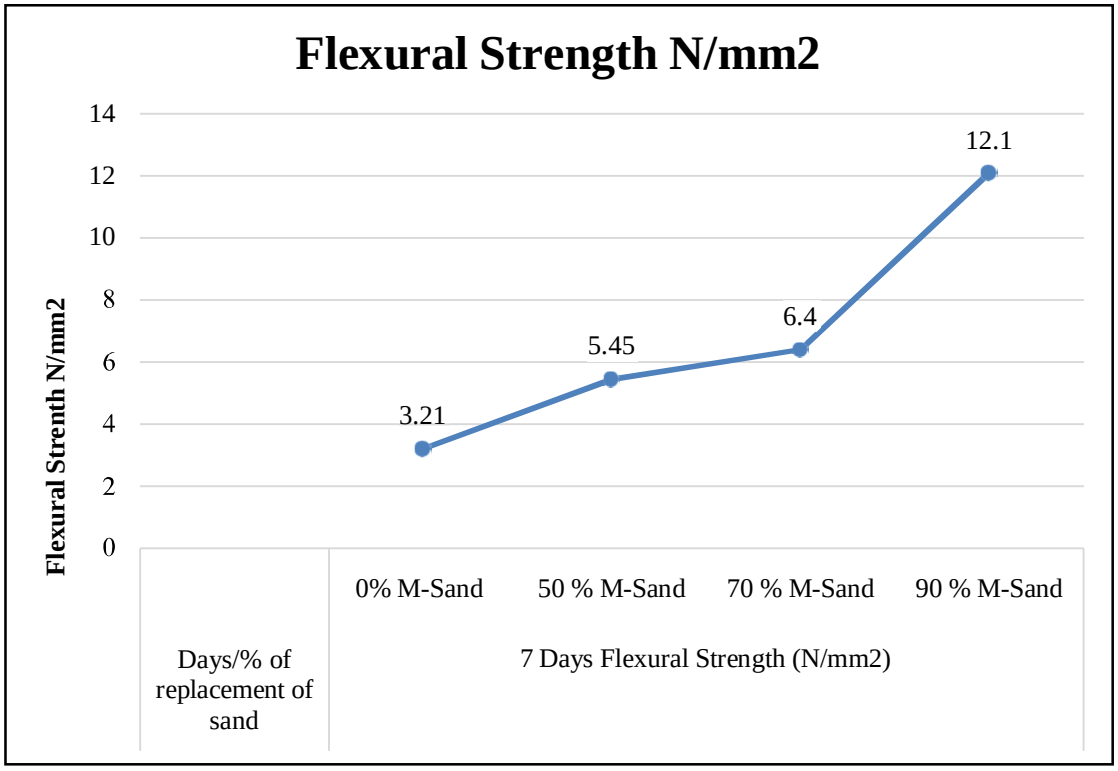

Figure 10 Line diagram of flexural strength of beam for 7 days curing

Table 5 Failure Modes and minimum Width of cracks

Beam no.	mode of failure	type of crack atfailure	experimental min. crack width
0 % M-Sand	shear	Diagonal	9.1
50 % M-Sand	flexural	Vertical	6.4
70 % M-Sand	shear	Vertical	7.2
90 % M-Sand	Shear	Diagonal	6.10

C. 14 Days Curing Test Results of Beam

Table 6 Flexure Strength and Failure Load of Beams

Beam no.	First crack load, Fc(KN)	Ultimate load failure, Fu(KN)	Fc/Fu	Flexural Strength(N/mm^2)
0 % M-Sand	7.6	8	0.606508876	3.89
50 % M-Sand	10.7	13.6	0.705882353	5.4
70 % M-Sand	13.2	18.7	0.95	6.8
90 % M-Sand	20.5	33.8	0.82	12.6

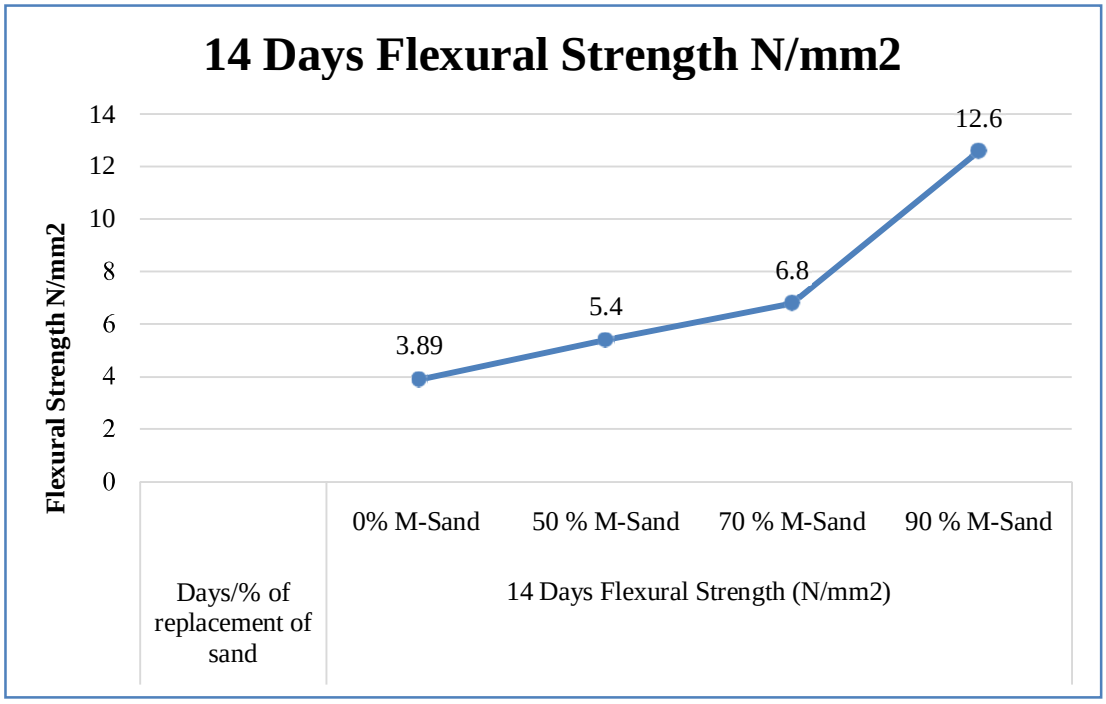

Figure 11 Line diagram of flexural strength of beam for 14 days curing

Table 7 Failure Modes and minimum Width of cracks

Beam no.	mode offailure	type of crack atfailure	experimental min.crack width
0 % M-Sand	shear	Diagonal	8.7
50 % M-Sand	flexural	Vertical	6.3
70 % M-Sand	shear	Vertical	6.9
90 % M-Sand	Shear	Diagonal	6.10

D. 21 Days Curing Test Results of Beam

Table 8 Flexure Strength and Failure Load of Beams

Beam	First crackload, Fc (KN)	Ultimateload failure, Fu (KN)	Fc/Fu	Flexural Strength (N/mm^2)
0 % M-Sand	7.9	8.15	0.969325153	4.1
50 % M-Sand	10.85	14.1	0.769503546	5.49
70 % M-Sand	14	18.9	0.740740741	6.95
90 % M-Sand	21.5	34.2	0.628654971	12.8

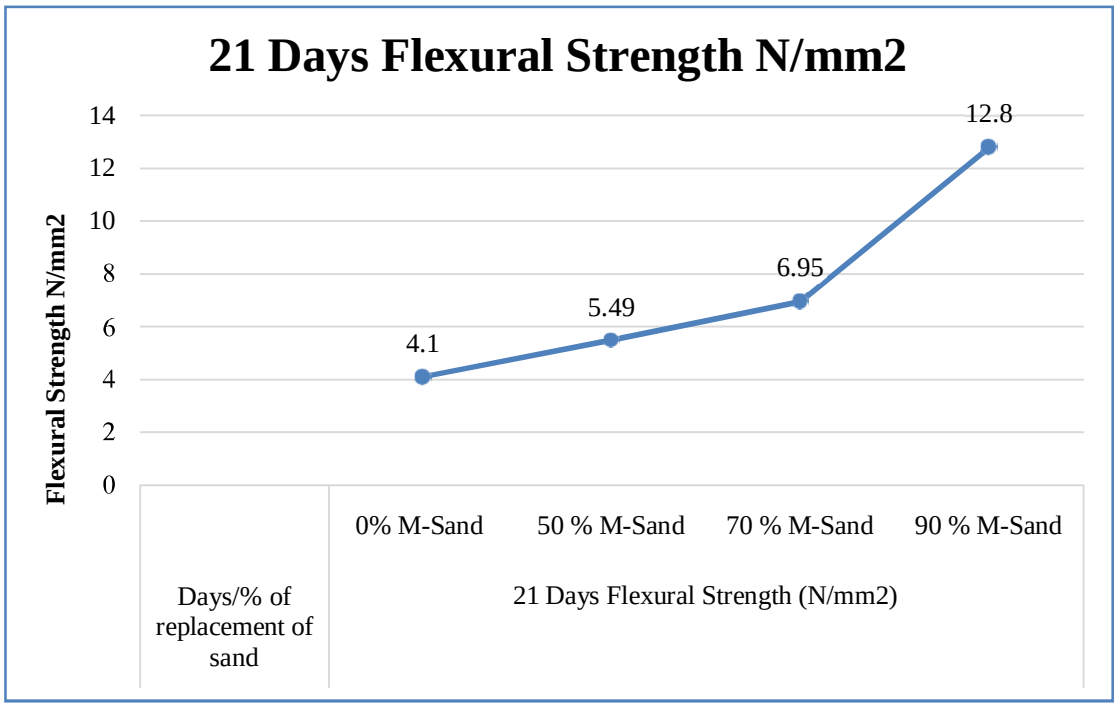

Figure 12 Line diagram of flexural strength of beam for 21 days curing

Table 9 Failure Modes and minimum Width of cracks

Beam no.	mode of failure	type of crack at failure	experimental min. crack width
0 % M-Sand	shear	Diagonal	8.56
50 % M-Sand	flexural	Vertical	6.1
70 % M-Sand	Shear	Vertical	6.86
90 % M-Sand	Shear	Diagonal	5.96

E. 28 Days Curing Test Results of Beam

Table 10 Flexure Strength and Failure Load of Beams

Beamno.	First crackload, Fc (KN)	Ultimate load failure, Fu (KN)	Fc/Fu	FlexuralStrength (N/mm^2)
0 % M-Sand	8.2	8.2	1	4.21
50 % M-Sand	10.9	14.32	0.761173184	5.5
70 % M-Sand	14.3	19.05	0.750656168	7.02
90 % M-Sand	21.9	34.8	0.629310345	12.9

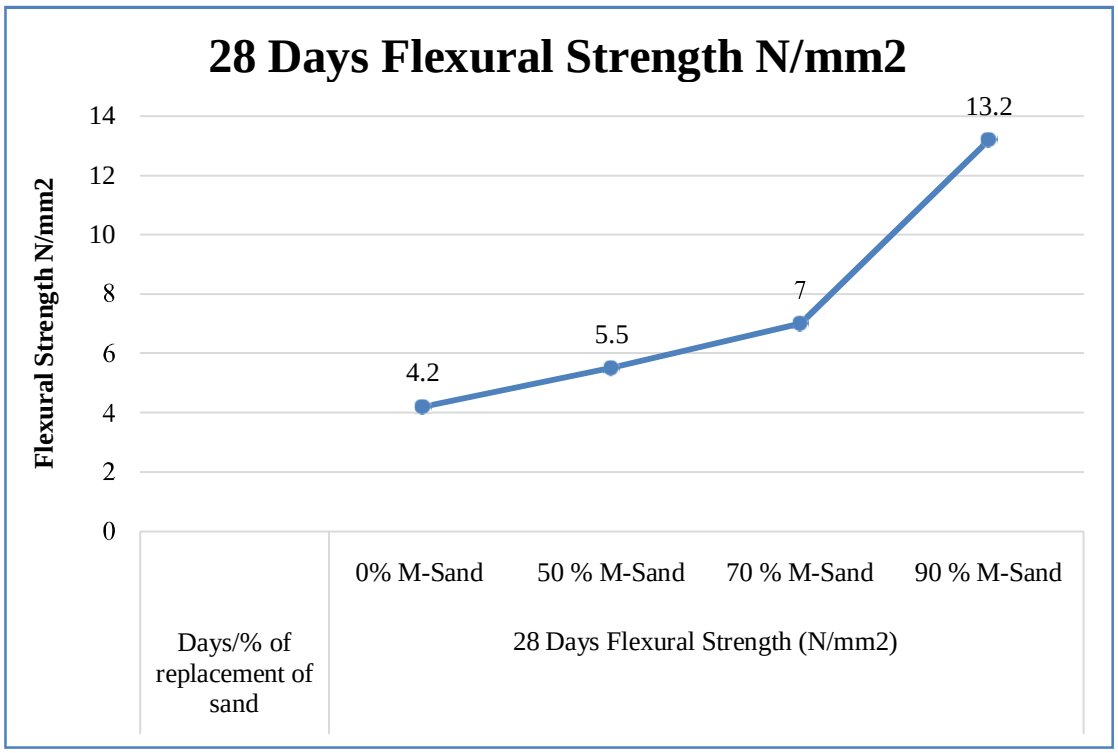

Figure 13 Line diagram of flexural strength of beam for 28 days curing

Table 11 Failure Modes and minimum Width of cracks

Beam no.	mode of failure	type of crack at failure	experimental min. crack width
0 % M-Sand	shear	Diagonal	8.45
50 % M-Sand	flexural	Vertical	6.0
70 % M-Sand	shear	Vertical	6.65
90 % M-Sand	Shear	Diagonal	5.85

V. CONCLUSION

A. *Conclusion*

Based on the present study, the following conclusions were drawn.

1) The addition of M-sand significantly increased the compressive of concrete with maximum strengths in each case being achieved at 90% of M-sand as per results observed in 7-, 14-, 21- and 28-days curing samples.

2) Compressive strength increased significantly with the addition of bamboo fiber and M-sand replacement strength is increased as percentage of M- sand in increased.

3) It is observed that adding bamboo fibre as an admixture it also increased theoverall performance of the concrete.

4) The mode of failure for 70% days and 90% days cured beams was shear, indicated by diagonal cracks because of the short-span specimen adopted and the relatively higher tensile strength than 0 and 50% m Sand beams which failed by flexure (vertical cracks).

B. *Future Scope*

1) In this study we are utilizing M-sand as a alternate of natural sand in proportion whereas in future one can completely replace it.

2) In this study we are considering Bamboo fiber as an admixture to enhance concrete properties whereas in future one can opt any other fiber or material to enhance properties.

3) In this study we are testing concrete whereas in future one can test for Reinforced concrete.

4) Replacement of natural sand with M-sand can reduce the excessive mining of the rivers and it can also minimize the dependency on natural resources in future construction.

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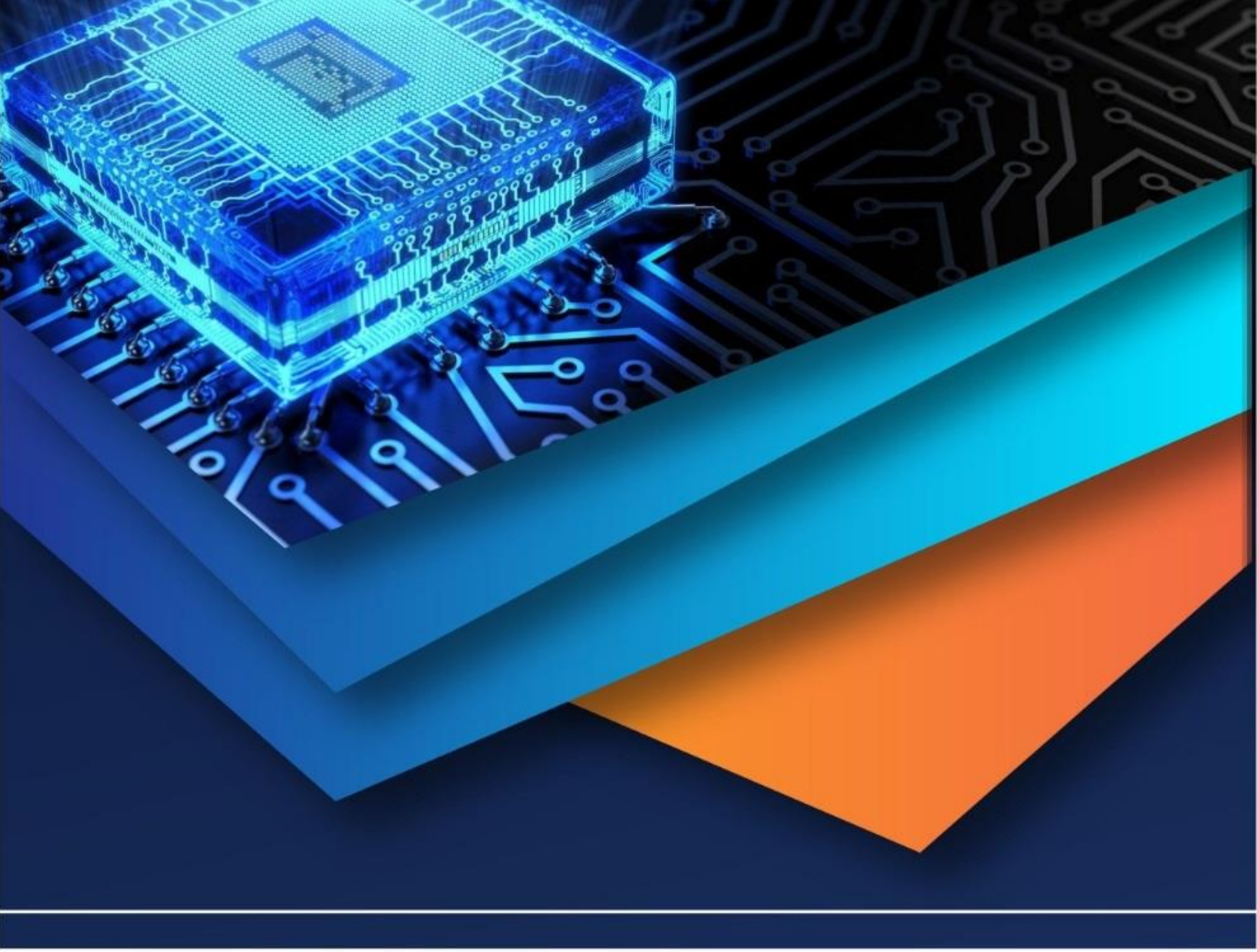

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